# plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

FEBRUARY 1955

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CLEPO
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A Soak Cleaner for the
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★ Rapid and thorough in action. Does not tarnish. Brass, Copper, Etc., on prolonged soaking.
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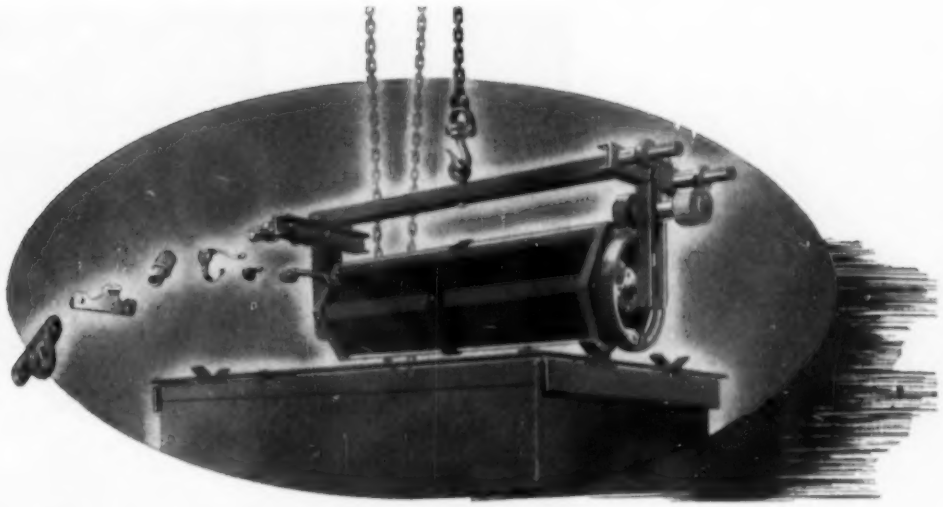

# Plating on Aluminum made EASY with Alumon

Hundreds of manufacturers throughout the United States are now using electroplated aluminum. The Alumon process is simple. The work is merely cleaned, dipped in acid, dipped in Alumon and is then ready for electroplating with copper, nickel, and other metals. The process is suitable for plating most wrought and cast alloys. . . The cost of using Alumon is low, being less than half a cent per square foot of surface area treated. The process can be fitted easily into regular plating cycles. Bulk or barrel plating readily done. Upon request we'll gladly send you the Alumon Process Bulletin.

**Write for literature on Alumon and check list of literature on sixty Enthone products and processes for better metal finishing.**

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METAL FINISHING PROCESSES

ENTHONE
INCORPORATED
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NEW HAVEN, CONNECTICUT

ELECTROPLATING CHEMICALS

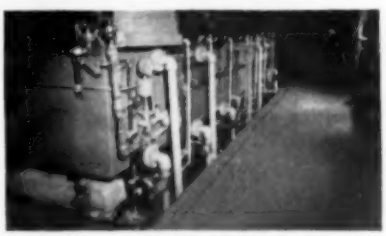
Completely automatic, unattended unloading end of the Stevens Automatic Barrel showing control panel and rectifier site located above machine.

# Unistrut says— "COSTS 50% LOWER— FINISH BETTER with . . . STEVENS AUTOMATIC BARREL MACHINE"

Every day in the Unistrut Corporation plant, Wayne, Michigan, thousands of small parts are zinc plated and shipped to Unistrut warehouses throughout the United States. All of these parts are zinc plated automatically by a Stevens Automatic Barrel Machine.

Unistrut high standards require a uniformity of plate on the parts used in their metal framing systems. But since installing the Stevens Automatic Barrel they have reported other advantages as well—"less handling, smaller inventories and quicker shipments." When you consider the 50% cost savings of actual plated parts too, it all adds up to a terrifically profitable investment.

Why don't you tell us your metal finishing problems and let us make recommendations. There's no obligation. Write to—



Side view of machine showing excellent drainage system.

Plating section of machine with ventilating duct work.

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Dedicated to the improvement and dissemination of the knowledge of the arts and sciences of electroplating and of finishing of metals and of allied arts

# plating

*Journal of the American Electroplaters' Society*

**February 1955** **Vol. 42, No. 2**

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# Two NEW Harshaw Bright Nickel Plating Processes

***Each** of these new outstanding Harshaw bright nickel plating processes have certain unusual characteristics which fit them to the product finish required in your plant.*

Top brightness with thin deposits . . . Especially outstanding color performance in applications where little or no basis metal finishing is done prior to plating . . . Perglow or Nubrite deposits are extremely receptive to chrome plating . . . Unique leveling results of Perglow or Nubrite have a hiding and filling effect on surface defects which other nickel deposits tend to emphasize. Polishing costs are decreased.

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# Editorial

## Knowledge Is Where You Find It

SINCE the beginning of our civilization progress has been dependent on communication. The more ideas are exchanged, the more man prospers and the faster he progresses. There are many means of communication, but some have become more developed and more effective than others. Among these *advertising* is perhaps the most powerful.

Through advertising, information of all sorts is passed on to everybody. It carries messages of knowledge and pure information presented excitingly, concisely, directly and without the abracadabra of textbooks and research reports.

In this modern day the magazine has become the supplementer of knowledge—and it covers every conceivable field. Here is a system of communication unequalled by anything ever before imagined. Advertising is the very nerve fiber of modern business and industry.

Messages, however, have two sides: sending and receiving. If one of these fails, the message is incomplete and therefore a failure. The reader of the modern magazine must respond to the vibrant appeal of the advertising message or the whole system of communication fails. The sending end is beautifully done, magnificently presented—an exotic fairyland of beauty and fact carefully merged to appeal to the onlooker who may grow great by the nourishment of the mind.

The reader of PLATING does himself a disservice when he takes the advertiser for granted. He throws away the greatest gift of modern times and retreats quietly into that static "do nothingness" which precedes intellectual and industrial death.

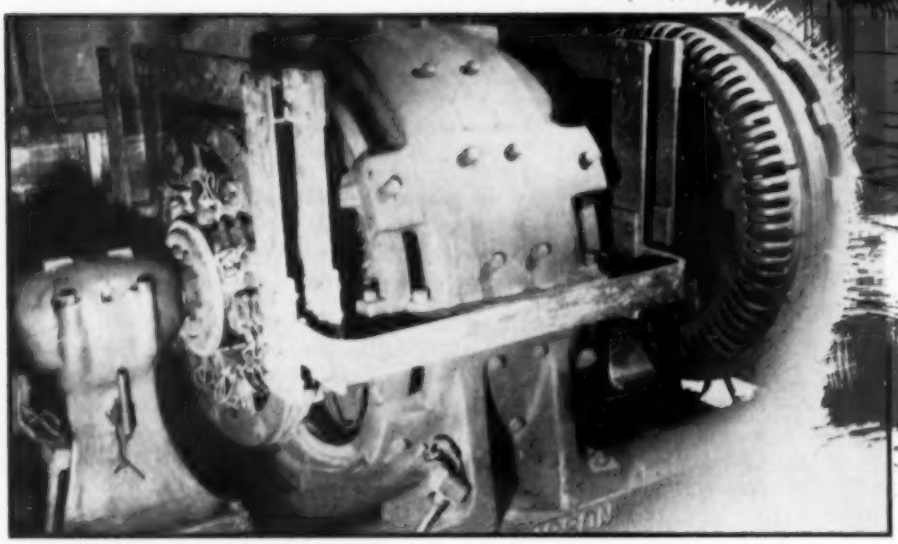
Every member of AES and every reader of PLATING should enter into the provocative invitation extended by our advertisers. They should "get into the act" with letters, comments, questions, requests, refutations, arguments, thank-you's and just plain observations—on advertising and editorial content which appear in PLATING.

THE EDITOR

Industry leaders choose *Chandeysson*

ELECTROLYTIC GENERATORS

EXAMPLE: **COLOR ANODIZING**
**AT ALUMINUM FINISHING**



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# OF ALUMINUM . . .

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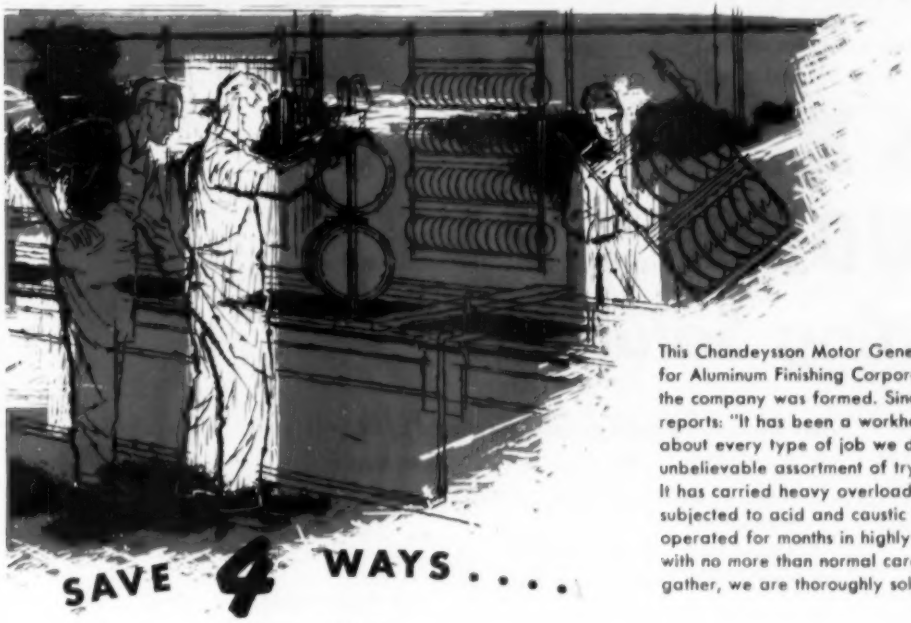

This Chandeysson Motor Generator went to work for Aluminum Finishing Corporation in 1936 when the company was formed. Since then the company reports: "It has been a workhorse . . . powering about every type of job we do under an unbelievable assortment of trying conditions. It has carried heavy overloads, it has been subjected to acid and caustic fumes, it has operated for months in highly humid atmosphere with no more than normal care. As you may gather, we are thoroughly sold on Chandeysson."

## SAVE 4 WAYS . . . .

USE LESS POWER . . .
precision-built for efficiency and built-in voltage regulation.

GET MORE OUT OF THE POWER YOU PAY FOR . . .
built-in high power factor at no extra cost.

BE SURE OF POWER WHEN YOU NEED IT MOST . . .
overload capacity as great as 50% momentarily and 25% sustained, without distress or damage.

ENJOY LIFETIME POWER DIVIDENDS . . .
sustained, lifetime overall constant efficiency as high as 85% does not decrease with age or overload.

CHANDEYSSON ELECTRIC COMPANY
4078 Bingham Avenue, St. Louis 16, Mo.

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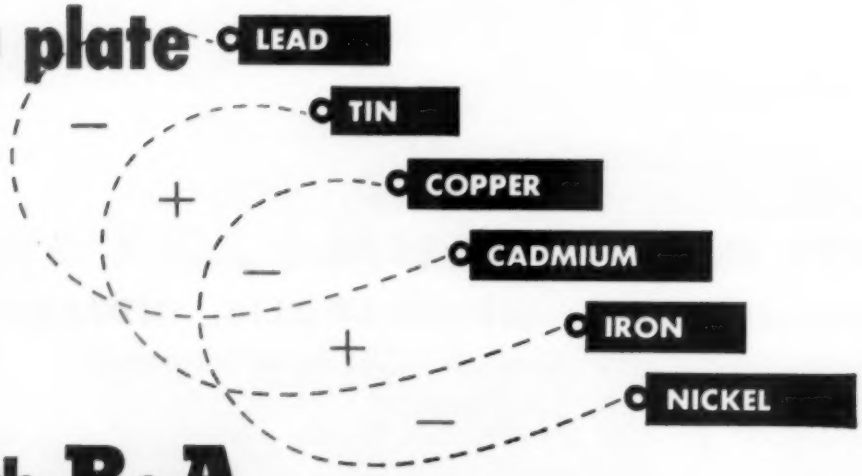
Company .....

Address .....

City ..... Zone ..... State .....

CHA-46

# These 10 Big Advantages Are Yours when you plate




## with B&A *FLUOBORATE* *Plating Solutions*

Special characteristics of B&A Fluoborate plating solutions enable platers to increase production while saving important amounts of scarce metals in many cases.

Baker & Adamson Metal Fluoborate solutions are provided already mixed—in concentrated form—and ready to use. They give you positive control, high-speed operation and easy handling PLUS lower operating costs.

***Here are 10 of the many advantages offered by B&A Metal Fluoborate solutions:***

1. No mixing or dissolving necessary . . . supplied in concentrated solution form
2. Easier bath preparation
3. Stability of bath composition
4. Ease of control
5. Practically 100% anode and cathode efficiencies
6. High conductivity
7. Good covering power
8. Fine-grained deposits of good color
9. Faster, high-speed operation
10. Readily adaptable for alloy deposits—lead-tin and lead-tin-copper alloys

**AND MANY MORE . . .**

In addition, each fluoborate bath has a number of special advantages for its particular applications.

Yes, all these advantages *and more* are yours when you use B&A Metal Fluoborates. Find out how you can profit by using them. Don't delay. Call or write your nearest B&A office listed below.

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SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

*Complete stocks carried here.

ALWAYS FINISHES FIRST

# —and saves on compound—it's "metered"!

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**the perfect liquid compound for all metal finishing**

How much of the compound in your buffing room is wasted... in the nubbin pile, or in "over-heading" buffs? There's a way to "meter" the compound you use—the Liquimatic way. An electrically timed system in the Liquimatic Process feeds the exact amount of liquid compound for the exact cut you need. While compound is being saved, buffs are being saved too ...continual lubrication extends buff life up to 400%.

These two cost-saving advantages alone soon pay for a complete Liquimatic Application System. But there are still other ways Liquimatic will help you cut costs. No hand application, and no changing of bars will effect substantial down-time savings for you... and Liquimatic's ease of cleaning means even further economies. Now—when production must be upped, and costs lowered — profit from Liquimatic—over and over again.

Check the other features of Liquimatic ...then write today for your free copy of Liquimatic's big, new folder that tells the whole cost-saving story of Liquimatic in *your* buffing room.

**Liquimatic ...**

***gives more buff mileage***

**These additional Liquimatic features mean real savings in terms of time, money, safety—**

- longer buff life
- completely automatic
- fast cutting
- easy cleaning
- non-settling
- high flash point
- long storage life
- sprayable viscosity
- adhesive slow-wearing buff face

1427

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# Equipment and Supplies

**Please use Reader Service Card to obtain any item in this section.**

**E—200. Snap Action Quartz Thermostat**—A new quartz thermostat, immune to chemical attack but extremely sensitive to temperature, has been announced by the manufacturer, N. J. Thermex Co., Inc.

By Thermex

These units consist of an outer chemically resistant quartz tube and a contained liquid which actuates the contact mechanism by expansion and contraction resulting from temperature changes.

Thermex quartz thermostats provide high capacity and are ideal when space is limited. Their rating is 5000 watts at 120–240 volts. Operating temperature range may be adjusted by a dial. The thermostat tube can be supplied in lengths from 6 to 36 inches. The present price range of these units is from $22.00 to $26.00 depending on the style.

**E—201. Steveo Bright Cadmium Process**—An improved process for electroplating of cadmium has been announced by Frederic B. Stevens, Inc.

Steveo bright cadmium process was designed especially to supply the demands of industry for a genuine bright cadmium deposit to meet definite thickness of deposit and corrosion protection specifications for iron and steel plating.

Use of an economical liquid brightener, Steveo liquid brightener, permits extremely easy control of the new process and allows complete and immediate integration with the solution. This feature increases economy in operation while providing an easier and faster method of handling additions as required.

**E—202. Placo Tank Rod Agitator**—The new placo tank rod agitator, designed for economical and dependable performance, has been introduced by Metal Finishing Manufacturing Corp.

The unit is fully insulated with bakelite arm and insulated rollers. It has ball bearing stainless steel shaft rollers, ball bearing gear box, V-belt drive to change speed, and an adjustable stroke up to 6 inches. It is easily mounted, clamps on to tank and has telescoping extended support and a 110 volt a-c plug in line and switch.

**E—203. New Line of Specific Gravity Meters**—A new line of specific gravity meters for liquid solutions, mixtures and slurries has just been announced by the Bristol Company of Waterbury, Conn.

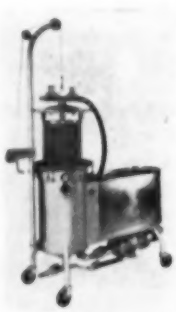
These meters operate by comparing the pressure necessary to displace a given head of the sample liquid in a bubbler pipe, with the pressure necessary to displace an equivalent head of water. The instruments used for this purpose can be calibrated directly in terms of specific gravity, Twaddell units, degrees Baumé, or other appropriate units. They can be used for any liquid into which a bubbler pipe can be inserted. The meters are factory calibrated for the liquid in question.

The new specific gravity meters use a Mercury meter body, with or without counterpoise, and a standard Bristol Series 500 recorder. The recorders can also be equipped to provide automatic control of the specific gravity, in any of five control modes.

In addition to the bubbler-type specific gravity meters, Bristol also offers its Electronic Dynamaster recorder and controller in conjunction with radiation-type density measuring units, for use in closed system measurements, such as pipes, tanks or processing equipment.

**E—204. New Silver Brazing Alloy**—A new silver brazing alloy specially developed to overcome crevice corrosion problems in brazing the 400 series straight chromium stainless steels has been introduced by Handy & Harman. This type of corrosion problem occurs most frequently where the brazed assembly is subjected to water, steam, or humid atmospheres.

Known as RSNI, the new alloy contains 63.0 per cent silver, 28.5 per cent copper, 6.0 per cent tin and 2.5 per cent nickel. It melts at 1325° F and flows at 1475° F. This alloy does not flatten out at brazing temperature to form thin fillet edges as do most silver brazing alloys. It is this characteristic which aids in preventing crevice corrosion. However, because of this sluggishness, particular care is required to flow RSNI into the joint. It is available in wire of any standard gage.



Space Saver

**E—205. Compact Filter**—A completely new, space-saving filter that incorporates a new filtration principle and gives double the filtering area and volume in the same space required by present filters on the market, has been announced by Bart-Messing Corp.

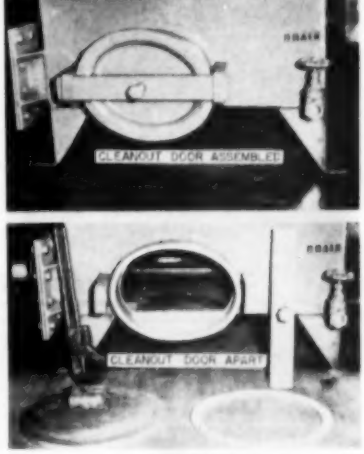
Bit Storage Made Easy

**E—206. Sierra Introduces New Bit Kit**—Convenient storage of tool bits is made possible by a new unit being manufactured by Sierra Engineering Co. The new unit, called the Sierra Bit Kit provides a convenient place to file costly tool bits. The Sierra Bit Kit is made of pressure die cast zinc alloy with a durable finish. The honey-comb design will hold 70 separate bits in any of these sizes—3/8, 1/4, or 5/16 inch.

Sierra's Bit Kit will fit in the top till of Gerstner boxes, Kennedy Kits and other popular tool boxes. Machinists appreciate the convenience of the Bit Kit in helping to keep their tool boxes shipshape.

**E—207. One Bolt Action Door**—A one-bolt action door, which can be opened in as little as five seconds, is featured as a time and labor saving improvement on Ranco vapor degreasers.

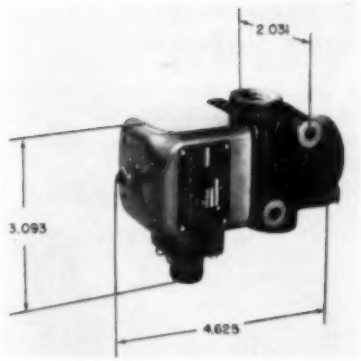
This development cuts down considerably the time it takes to disconnect steam lines, loosen and remove frozen bolts. A further advantage of the one-bolt action




Five Second Bolt Return

door is that it may be removed repeatedly without gasket replacement.

Additionally, the Ranco one-bolt action door design affords complete drainage, while trapping all sludge in an easy-to-clean pocket.




Has Varied Applications

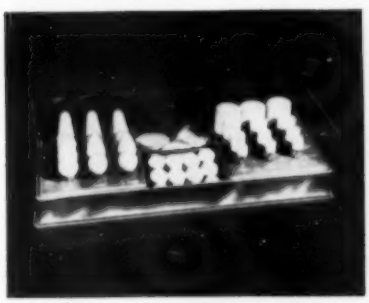
**E—208. Pneumatic Valve**—Mar Vista Engineering Co., Los Angeles, Calif., manufacturer of hydraulic valves, announced their entry into the pneumatic valve field.

A complete selection of solenoid operated shutoff and selector valves for aircraft, guided missiles, and industrial applications are offered.

Special emphasis on ease of maintenance has been preserved in engineering and manufacturing.

A few of the technical features of the pneumatic valves are: pressure range from 0 to 3000 psi, temperature range (−) 65° F to (+) 265° F, electrical current drawn, less than one amp at 24 volts d-c continuous duty; complete technical data sheets are available to engineers.

**E—209. New Felt Bob Assortment**—A new assortment of paramount brand felt bobs packaged in a box that doubles as a handy bench-top holder for the bobs when they are not in use is now available from the Bacon Felt Company, Taunton, Mass.



Bob Box for Bench Tops

The bobs in the K-I assortment are mounted on ⅛-inch mandrels and include 12 plain shapes consisting of four sizes, each in soft, medium, hard and rock hard, and 16 standard shapes also in four sizes, each in four degrees of hardness. In addition, the assortment includes 36 wheels in assorted sizes and densities, a ⅛-inch mandrel on which the wheels may be mounted, and six 2 x 2 inch squares of rubbing felt for final hand finishing touch-ups.

**E—210. Improved H-VW-M Sisal Buffs**—Hanson-Van Winkle-Munning Co., Matawan, N. J., announces four major improvements in its sisal buffing wheels that make for longer wear and faster cutting. The improvements are; treatment with an impregnating material, new center construction, improved sewing and use of a stronger sisal cloth.

Called Binderized Bias Sisalweev Sections, the new buffs are impregnated with the same organic material that is used as a binder in buffing compositions. The impregnated binder improves the adherence of composition to buff, besides lubricating and making the buff more flexible. With the binder, buffs cut faster, last 30 per cent longer.

Centers of the new sisal buffs are made flat and plain. Tests show that this eliminates the possibility of the buff streaking or ringing the surface of a piece of work. To improve wear, the new buffs are sewn under greater tension and with heavier thread.

MARK YOUR CALENDAR NOW TO ATTEND THE FOURTH INDUSTRIAL FINISHING EXPOSITION

JUNE 20 21 22 23 1955

PUBLIC AUDITORIUM
CLEVELAND, OHIO

ONE idea picked up at the convention or show might save you thousands of dollars in the operation of your plant.

All sessions of the 42nd Annual Convention of the American Electroplaters' Society will be held under the same roof with the Industrial Finishing Exposition.

Every phase of industrial finishing, both organic and inorganic, will be covered.

**Watch for programs, activities, and information about educational sessions to be announced later.**

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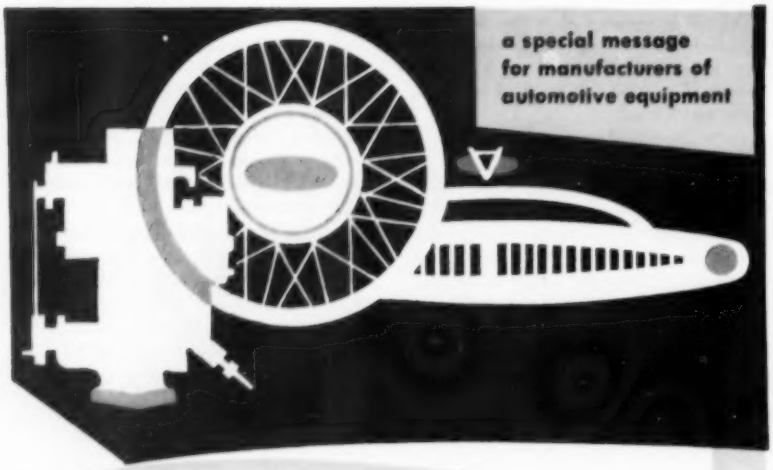
**1955 INDUSTRIAL FINISHING EXPOSITION**
**1849 West 24th Street, Cleveland 13, Ohio**




need a finish for low cost corrosion protection or showroom sparkle?

specify IRIDITE®

Whether you're finishing non-ferrous parts for high corrosion protection, paint base, or for showroom sales appeal, you can be sure of low material and production costs and peak performance when you specify Iridite. Here's what you can do with Iridite:

- **ON ZINC AND CADMIUM** you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.
- **ON COPPER . . .** Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.
- **ON ALUMINUM** Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.
- **ON MAGNESIUM** Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

**AND IRIDITE IS EASY TO APPLY.** Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

**WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.**

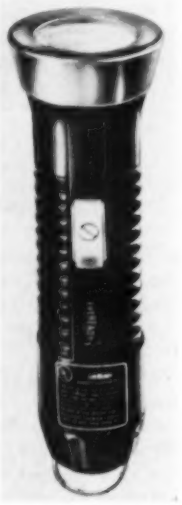
Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.
WEST COAST LICENSEE: L. H. Butcher Co.


# Equipment and Supplies

**E—217. New Heavy-Duty Industrial Flashlights**—Two new heavy-duty industrial-type flashlights—one a new approved safety type—have been announced by National Carbon Company, a Division of Union Carbide and Carbon Corporation. They are recommended for use by railroads, public utilities, refineries, chemical plants, and other industries requiring rugged dependability, long life and safe operation.



Rugged Light

The new Eveready heavy-duty flashlight has an insulated ethyl cellulose case that will not shatter, crack or dent and is resistant to temperature extremes; it withstands deterioration from water, oils, greases, gasoline, alcohols and acids. The flashlight also has a self-lubricating, hand-replaceable insulated slide switch and a special lens guard made of tough polyethylene which protects the lens and throws a powerful red safety warning light.

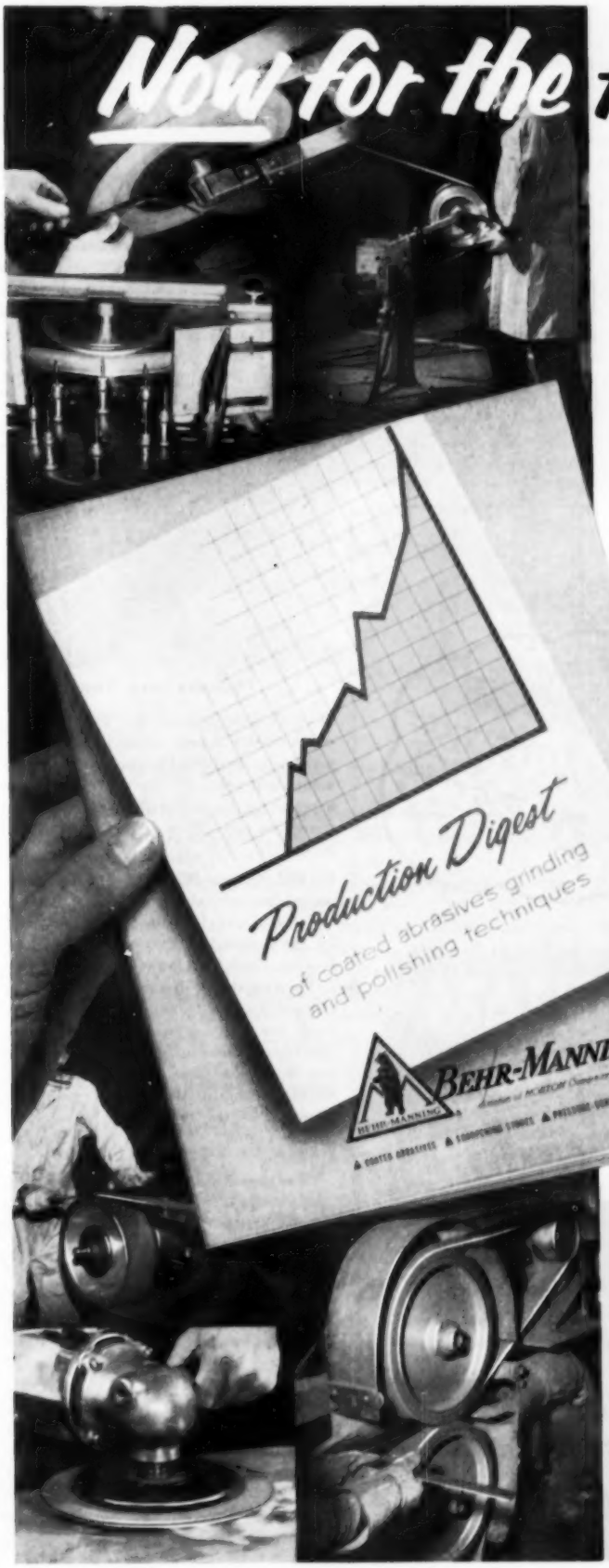
The Eveready safety flashlight is approved by the U. S. Bureau of Mines and listed by Underwriters' Laboratories, Inc. It has the same features as the heavy-duty model, plus an extra lamp in the bottom cap. The safety flashlight is so designed that if the lamp is broken, the filament is snuffed out instantly before it can ignite inflammable or explosive mixtures of gas in the surrounding atmosphere.

**E—218. New Portable Gas Sampling Unit**—A new portable gas sampling unit, the Model Y-101, has been added to the line of advanced instruments manufactured by Arnold O. Beckman, Inc. The Model Y-101 provides a compact system for bringing sample gas streams to an analyzer for measurement.

New Model

It consists of a sturdy motor-driven pump, filter, flow indicator, valves, and a 20-foot power cord, all mounted and interconnected in an aluminium case. The unit may be easily attached to an Arnold O. Beckman

(*Continued on page 120*)

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This comprehensive manual, written by BEHR-MANNING Methods Engineers, is the first known effort of its kind in the field today. It contains detailed information which will help you solve grinding and polishing problems as well as suggest new and practical application methods.

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- Contact Wheels Influence Abrasive Belt Performance
- Tumbling and Countersinking Costs Cut by Abrasive Belt Methods
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- Wet Belt Grinding Speeds Production of Extruded Cylindrical Stock
- Abrasive Belts Reinforced with Strapping Tape Last Longer
- Lubricants Aid Abrasive Belt Grinding and Polishing
- Special Abrasive Cloth Shapes Save Man-Hours
- Smooth Out Your Disc Grinding Problems
- Coated Abrasives Grind Wide Stock to Closest Limits
- How to Cut Spiral-Wound Abrasive Drum Covers
- The Preparation of Wood Prior to Finishing
- What's New in Wood Sanding Machinery and Methods
- Eight Ways to Cut Costs on Coated Abrasives

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G-2

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## *Equipment and Supplies*

(*Continued from page 118*)

Model C2P oxygen analyzer or can be supplied with a handle for independent operation.

No special skill is needed to operate the Model Y-101 sampling unit. The line from the stream to be analyzed is connected to the intake part of the unit. The pump operates on 115 volt ac.

**E—219. Kocour Sulfate Test Set**—The Kocour sulfate test set is now available with either of two centrifuges, a compact hand-driven centrifuge and the convenient electric centrifuge. This analytical set determines the sulfate content in a chromium plating solution. Additional procedures are available for determining sodium sulfate or epsom salts in nickel plating solutions. Operation of this test set is very simple. It was designed so that anyone can make a test. No knowledge of chemistry is required.

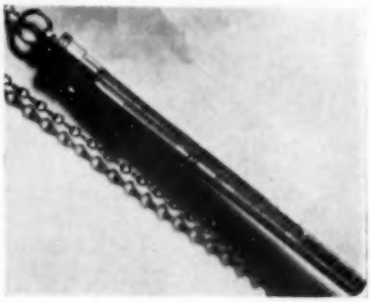
**E—220. Safety Switches**—Federal Pacific Electric Company, Newark, is producing a new and improved line of Type D (Nema Type G) safety switches, in 30, 60, 100, 200, 400 and 600 amp capacities.

The 30 ampere line of type D safety switches has been redesigned to embody the same desirable plus features that make all Federal Noark switches easy to install and maintain, and guarantee long switch life.

Federal Noark type D switches feature solderless lugs and feed-through neutral for quick installation. Ample gutter space is provided for ease in wiring. Visible knife blades insure safety, and all live parts are completely recessed to eliminate the danger of accidental contact.

Dual blade construction and fewer joints assure cool operation and trouble-free service. All moving parts and contacts are readily visible for inspection and maintenance.

**E—221. Cleanout Indicator**—A boon to users of vapor degreasers is the new Ramco Cleanout Indicator. Developed to save many dollars in cleanout costs, this specially designed instrument tells the exact condition of the solvent in the degreaser. It eliminates guesswork and makes it a simple and effortless job to keep an accurate check at all times. Calibrated for both trichlorethylene and per-



**Eliminates Guess Work**

chlorethylene solvents, the Ramco cleanout indicator is easy to read, and may be carried in the breast pocket as readily as a fountain pen. It comes complete with a performance and control chart and instructions on "How To Clean a Degreaser."

**E—222. Two-Wire Thermocouple**—A new two-wire thermocouple, encased in stainless steel tubing, has been introduced by the Industrial Division of Minneapolis-Honeywell Regulator Company.

The new device is available with either of two types of terminal heads; an open head assembly or a screw-cover head. The latter comes in two sizes. The stainless steel protecting tube is expected to double the life of the new thermocouple. Accuracy of the new device is rated at plus or minus 5° F over a range from 0° to 1000° F.

Fiberglass insulation in the new model thermocouples permits greater application flexibility than is possible with the ceramic-insulated pencil-type models.

Lengths of the thermocouples range from 6 to 60 inches. Lengths of 35 feet are available on a special basis.

**E—223. New Spray Type Cleaner**—A new low-priced, highly effective spray type cleaner that combines solvent, wetting agent and alkaline as a multi-phase cleaner was announced by the Van Straaten Chemical Company of Chicago.

The new cleaner, Vantrol 5618, is especially effective on steel, according to initial use in plants where it has been field tested.

(*Continued on page 123*)

# 10 REASONS WHY THE COUNTRY'S FINEST COATERS USE

# MICCROSOL

VINYL PLASTISOL

# FOR INDUSTRIAL COATING!

1 They know that MICCROSOL is the highest quality material they can use.
2 MICCROSOL has become the accepted standard for coating plating racks, baskets, hangers, hooks, fixtures, ducts, tanks, tools, and many other parts.
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4 The permanent flexibility and positive, continuous adhesion of MICCROSOL enable them to meet the strictest specifications and technical requirements, for protective coatings.
5 They can depend on MICCROSOL to keep their reputations, and the quality of their work, at the highest level in the industry.
6 They have helped us develop MICCROSOL to its present point of perfection.
7 MICCROSOL is easier to apply. Gives you better coatings for less money.
8 MICCROSOL responds to their skill and experience. Helps them give you the rugged coatings you need to protect work and your equipment.
9 MICCROSOL coatings last longer.
10 They can depend on MICCROSOL!

You can't blame us for being proud of the quality of the coating work produced by our customers. We have worked with them, and for them, to the very best of our ability, during the phenomenal growth of the coating industry. We know them well, and appreciate their loyalty and support. And we hope to have the privilege of serving them all for many years to come.

There's a MICCROSOL Coater located in your vicinity. He's undoubtedly the leader in his field. If you want superior coating jobs, we'll be glad to help you get in touch with him!

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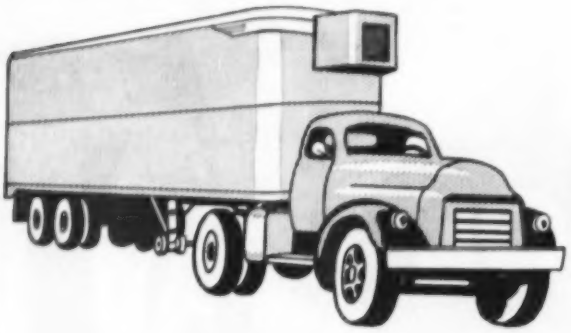

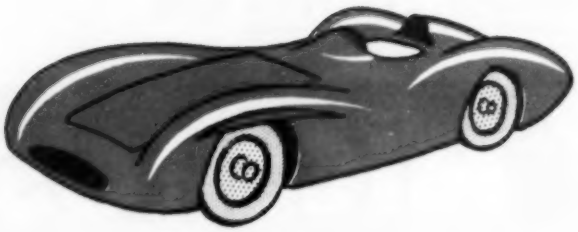

**PERMA-BRITE "S"**
(for still or automatic)

**PERMA-BRITE "B"**
(for barrel)

## For Economical Bright Zinc Deposits

The most important cyanide zinc plating development in 15 years, Perma-Brite Zinc Brighteners are most economical in giving wonderful, bright zinc deposits, preferably after bright dipping; high throwing power and covering power; perfect for conversion coatings; wide effective concentration range; added directly to the plating bath once a week or once a day as desired; stable in idle baths; makes zinc anodes corrode smoothly.

**ROHCO 303**
(for still or automatic)

**ROHCO 100**
(for barrel)

## For Brilliant Zinc Deposits

Rohco 100 Barrel Brightener imparts brilliance to zinc plating that is almost unbelievable until observed. It exhibits high covering power so that recesses, usually unplated, are easily covered with a substantial thickness of deposit. ROHCO 303 Still Brightener gives unusually bright deposits that offer ideal surfaces for bright dipping to even greater lustre or for conversion coatings by chromic acid treatment.

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Get it "straight from the shoulder!" Your Distributor will gladly give you names of enthusiastic users and complete information. After fair trial of ROHCO ZINC BRIGHTENERS you, too, will be a solid booster! Pick up your phone, right now!

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Ardco, Incorporated, Chicago 38, POrtsmouth 7-2015

Armalite Company, Ltd., Toronto 6, Canada, RIverside 2455

Crown Chemical and Engineering Co., Los Angeles 63, ANgelus 2-2193; San Francisco 24, MIssion 8-1444

Daniels Plating Barrel & Supply Co., Newark 5, MArket 3-7450

Davies Supply & Manufacturing Co., St. Louis, MOhawk 4-9332

Enthone, Inc., New Haven, SPruce 7-5581; Binghamton 4-2897

W. D. Forbes Company, Minneapolis 14, Lincoln 6917

George L. Nankervis Co., Detroit 23, VErmont 8-5780

## *Equipment and Supplies*

(*Continued from page 120*)

In addition to its effective removal of shop and mill oils, drawing compounds and heavy greases, the new industrial washing machine cleaner also has the added values of rust protection, will not coat a machine with the oil removed from the parts, will not clog nozzles or require severe maintenance, is nonfoaming and is at least three times faster in cleaning than most cleaners.

The new cleaner is free flowing, nondusting and noncaking. It is normally used from a half to two ounces per gallon. When used at a quarter ounce per gallon in the rinse, it gives adequate rust protection. Furthermore, the developers state the product is not toxic and will not irritate operator's hands under normal conditions.

**E—200. Lanco Lattice Rod Support Clamps**—Without disturbing lattice framework and apparatus already set up, Arthur S. La Pine & Co. introduced a Lanco rod support clamp that can be attached at any vacant space along a lattice rod. From this clamp another rod can be extended to support additional apparatus. Changes in lattice framework and supported apparatus can be made with no time lost for dismantling.

Double Duty

Lattice rods fit exactly into horizontal and vertical grooves in the clamps and are firmly fastened by Allenhead screws that are tightened with an ordinary hex wrench.

Clamps are made of zinc alloy, cadmium plated, and the Allenhead set screws are of oxidized steel; all designed to resist corrosion.

Rolled aluminum alloy lattice rods that are used with the clamps are centerless ground to close tolerances which ensure a perfect fit and a rigid lattice structure. Rods measure ½ inch in diameter and can be furnished in standard and special lengths.

**E—200. New Vise Jaw Protector Plates**—A new and effective set of aluminum plates that quickly convert a regular bench vise into a vise for wood or highly finished metal parts has recently been introduced by the Robbins Mfg. Co. The aluminum plates attach easily to the vise jaws and are securely held in place by tempered spring clamps. With these plates in place there is no need to fumble with blocks of wood or metal as protectors. Soft work pieces may be clamped directly in the vise and held firmly without damage. There are no set screws or bolts so they can be quickly removed when the serrated jaws of the vise are needed. The gripping surfaces are easily kept smooth and in good condition with ordinary sand paper.

Gentle

**E—200. New Gard Anti-rust Spray**—A brand-new product by Gard Industries, Inc., one of the nation's leading aerosol producers, is Gard Antirust Spray. Packaged in Gard's handy push-button container, this new rust proofer contains silicones and polar compounds specially formulated to prevent rust and corrosion in outdoor storage for a year and, in indoor storage, for five years. A simple press of the Gard lever releases a noncreeping, self-healing film that displaces water and neutralizes fingerprints on guns, tools, reels, and other fine equipment.


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ZIPPO CLOTH BUFFS

These famous long-wearing buffs run cool under all buffing conditions. High count bias-cut cloth is assembled on ventilated steel centers. Each section is perfectly balanced and faced—requires no raking.

BUFFING COMPOUNDS

Formax produces a complete line of buffing compounds in bar, tube and liquid form.

Our extensive manufacturing, laboratory and testing facilities are at your disposal.

ZIPPO SISAL BUFFS

You have a pleasant surprise coming if you haven't tried the new Zippo bias-type sisal buff. It was specifically developed for steel buffing—to blend polishing grit lines—to cut down stainless steel—and bring up a bright lustre.

Other Formax products include the well-known C-20 Flexible Contact Wheels and F-26 Abrasive Belt Grease Stick.

*Descriptive Catalogs Sent on Request*

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"THE FOUR McALEERS"

# Personals

**James S. Hubbard** and **Charles J. Martin** were appointed sales managers of Wyandotte Chemicals Corporation district offices, according to an announcement by **Fred Tholen**, sales manager of the J. B. Ford Division of Wyandotte Chemicals Corporation.

Hubbard, a native of Richmond, Va., has represented Wyandotte Chemicals as a salesman for six years. His previous business connections were General Motors, Atlantic Coast Line Railroad and two well-known Wyandotte Chemicals jobbers—Virginia-Carolina Laundry Supply Corporation and Sterling Supply of Philadelphia.

Hubbard

Martin

Martin, a native of New York City, has represented Wyandotte Chemicals for six years. He has studied at New York Business Institute, served five years in the U. S. Coast Guard, has worked for an auto-truck body manufacturer and assisted in the merchandising and erecting of some of the first all-steel homes.

Both Hubbard and Martin have thorough and practical field experience in the many different industries served by Wyandotte Chemicals' cleaning, washing, germicidal, metal cleaning and absorbent products. Both new managers have recently been given intensive refresher training at the Wyandotte Chemicals Research and Technical Service Laboratories.

**W. K. Schmalzriedt,** formerly assistant manager of the tin plate division of American Can Company's general purchasing department, has been appointed manager, the firm announced. He succeeds **W. J. Koslow**, who has retired.

**D. C. Storch,** formerly assistant manager of Atlantic division tin plate purchases, has been named to succeed Schmalzriedt as assistant manager of the tin plant division.

Storch has been with the can making firm since 1949 and was formerly in Canco's central division office. He is a graduate of the University of California and received his M.B.A. degree at Harvard Business School.

**Dr. R. H. Lueck,** formerly general manager in charge of American Can Company's research and technical department, has been elected vice-president in charge of the department, it was announced by **William C. Stolk,** president.

The scientist, who has been with the company for 32 years, will continue to make his headquarters in New York. The position to which he has been elected is a new one in the firm.

The appointment of **Dr. William A. Fessler** as director of development of Daubert Chemical Company, Chicago, was announced by **George A. Daubert,** president. Dr. Fessler was formerly assistant to the chief of research, Nitrogen Division, Allied Chemical & Die Corporation, Hopewell, Va.

**Louis S. Mann** has been appointed general sales manager of Daubert Chemical Company, Chicago, Mann was formerly sales manager of the Fendix Division which handled the sale of Fendix automobile undercoating.

Daubert Chemical was known for 20 years as Nox-Rust Chemical Corporation, the name having been changed January 1. The firm manufactures rust prevention products, sound deadeners and adhesives.

**L. V. Showalter** has joined the organization of Weaver Engineering & Supply Co., Inc., Grand Prairie, Texas. **James E. Weaver,** president, states that Larry Schowalter will be chiefly responsible for the promotion of the supply items distributed by this concern in southeastern states—Euthone, Inc., Formax Mfg. Co., R. O. Hull & Co., Dixon, Rippel, etc. Due to Schowalter's experience in heat-treating, the company has added heat-treating supplies to their other lines.

Showalter

Schowalter, a metallurgist by trade, formerly held the position of foreman of plating and heat-treating at Chance Vought Aircraft, Inc., from 1949 to 1953. Previous to his employment at Chance Vought, he held similar responsible metallurgical and supervisory positions with Thompson Aircraft Parts Co., Johnston and Jennings, Frantz Mfg. Co., and Machine Products Co.

Schowalter, a native of Cleveland, Ohio, is thirty-nine years of age, married and has three children.

**Daniel R. Dunkle** has been appointed to the sales staff of Apex Alkali Products Co., as its Pittsburgh representative Dunkle is a graduate of the Pittsburgh Institute of Aeronautics. Prior to joining Apex, he held the position of supervisor at Bell Aircraft Corp., Buffalo, N. Y., and participated in the development of the helicopter in the experimental division. Prior to returning to the East, Dunkle was a member of the U. S. Helicopters, California, and was divisional sales manager for this group. He has served in the U. S. Air Force where he received extensive electronic training.

Dunkle

Dunkle has been a representative for Walter Kidde Co. and Aviation Lubricants, Inc.

**Elmer G. Schacht,** president of Behr-Manning Corp., Troy, N. Y., has announced that **Edwin C. Evans** has been made vice-president and assistant general manager, and **William I. Clark, Jr.,** has become assistant to the president in addition to his present responsibilities as secretary of the company.

Evans joined Behr-Manning in 1934 as a member of the sales analysis department. In 1936 he entered the purchasing department, becoming assistant purchasing agent in 1941 and purchasing agent in 1946. In January, 1950, Evans became assistant to the vice-president in charge of engineering and manufacturing, and in October 1952, he was made director of manufacturing. In January 1953, he was made a director of Behr-Manning and in January 1954, he became vice-president of the company.

Evans attended Rensselaer Polytechnic Institute, and the Advanced Management Program of the Harvard Graduate School of Business Administration.

Evans

Clark

Clark joined Behr-Manning in July, 1933, as a credit clerk. He served as assistant to the controller from 1935 to 1942, at which time he became production manager of the aviation division. Clark was made assistant secretary of the com-

pany, personnel director and office manager in 1947. He was elected a director of the company in 1952 and was appointed chairman of the operating board in 1952 and in 1953.

He served as assistant clerk of Norton Pike Co., a Behr-Manning subsidiary, from 1947 to 1952; assistant treasurer, 1947 to 1952; director of the company from 1949 to 1952; and was elected secretary of the company in 1952.

He is a graduate of Milton Academy and Harvard University and attended the Advanced Management Program of the Harvard Graduate School of Business Administration.

Another improvement in Frederic B. Stevens, Inc., customer service program, a new pilot plant for experimental zinc, cadmium, copper and nickel automatic barrel and conventional plating, is now in operation. The new pilot plant is also designed to provide study and analysis in the problem of Metal Finishing Waste Disposal.

Matosh

Helping in the establishment of the new pilot plant was **Victor G. Matosh** who recently joined Stevens as plating service engineer.

Prior to joining Stevens, Matosh was with Burroughs Corporation for two years as an electrochemist in the plating laboratory. Before that he worked with Houdaille-Hershey Corporation and Ford Motor Company as a chemical engineer in the inspection laboratory and as a process control observer in the engineering department.

Matosh graduated with a B.S. in Chemical Engineering from Lawrence Institute of Technology, Highland Park, Mich., after serving three years with U. S. Army Ordnance.

Robertshaw-Fulton Controls Company announced the addition of four aircraft and missiles specialists to the staff of its Aeronautical Division research and development laboratory.

The new staff members are **Dr. Leland G. Cole**, director of the dynamics laboratory; **Dr. W. M. Roberds** and **Maynard D. McFarlane**, research scientists, and **C. J. Thompson**, chief design engineer.

Dr. Cole, formerly director of the University of Michigan's rocket propulsion laboratory, has served as chief of the university's Willow Run research center and as senior research engineer at the California Institute of Technology. During the past several years he has acted as consultant to government and industry on rocket engine, gas generator, combustion, ignition, heat transfer, propulsion, explosives and related matters.

Before joining Robertshaw-Fulton, Dr. Roberds was staff engineer and assistant to the chief engineer of the Firestone Tire and Rubber Company's guided missiles division. He has also been administrative engineer and guidance systems consultant for North American Aviation and high frequency power specialist for Radio Corporation of America. Dr. Roberds holds patent applications on 19 induction heating techniques and on several electrical circuits and circuit components for high frequency power and instrumentation.

McFarlane, formerly a senior industrial engineer at the California Institute of Technology, has worked on the production of guided missile systems and has served as consultant to the U. S. Army Ordnance Corps. He is co-inventor of the Bartlane system of facsimile transmission and holds numerous patents in the fields of radar, facsimile and communications.

Formerly a senior design engineer at North American Aviation, Thompson has worked on atomic energy research and missile handling and testing and for a time was instructor in design engineering at the University of Kansas Extension School.

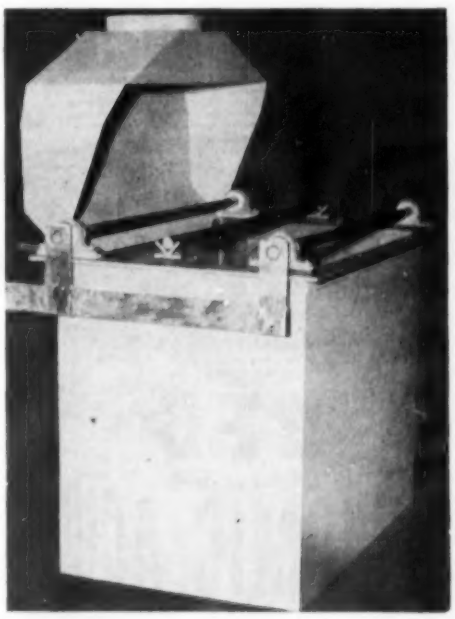
Esten

Bedard

**Ralph V. Esten** and **Eugene A. Bedard** have joined the industrial department of Wyandotte Chemicals Corp.—Esten headquartering in the company's Los Angeles office, Bedard in San Francisco.

Broomhead

**George W. Broomhead** has recently been transferred from Wyandotte Chemicals' Dallas territory to their Los Angeles sales and service staff. Broomhead has many years of experience with industrial chemicals—both in the field and in laboratories.

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42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

*Manufacturers of Welded Fabrications to Specification*

## Personals

**Howard D. Tindall** has been appointed manager of the transformer division of Federal Pacific Electric Company; Newark, N. J., it was announced by **Thomas M. Cole**, executive vice-president. His duties will include the management of Gardner Electric Manufacturing Company, San Francisco, a wholly owned subsidiary of Federal Pacific.

Tindall was formerly associated with Moloney Electric Company where he was a vice-president and assistant chief engineer.

During World War II, Tindall served in the U. S. Army Signal Corps, and attained the rank of major. He was assigned to the Signal Corps Development Laboratories at Fort Monmouth, N. J., where he supervised the development of various types of communication equipment.

Following his graduation from Ohio State University in 1936, Tindall joined the Wagner Electric Corporation where he designed distribution and power transformers.

**George W. Belcher** has been appointed Central District manager of sales and technical service of the Titanium Metals Corp. of America, Chicago.

Belcher is a graduate of R. P. I. with a B.S. degree in Metallurgical Engineering. He was formerly employed by Allegheny Ludlum Steel Corp., Watervliet, N. Y., where he held the position of production metallurgist, mill metallurgist and technical service representative.

Seguin, who joined the company in 1952, was formerly in the tool engineering department. Prior to joining American Thermometer, he was tool engineer of the Curtis Manufacturing Company in St. Louis.

A native of St. Louis, Seguin attended Washington University, and is a veteran of World War II.

**E. J. Weller,** carbide design and application engineer, Carboloy Department of General Electric Company, Detroit, has been named manager of tool sales, with headquarters in the home office.

Weller, who joined Carboloy Department early in 1954, began his career with General Electric Company in 1937 as an apprentice machinist in the Turbine Division, Schenectady, N. Y. Upon completing the company's apprentice training course, he became a die maker. He later was transferred to the materials and process laboratory of the Turbine Division.

Besides being an author of several articles on development of improved tool designs and machining practices, Weller is active in the metal cutting committee of the ASME, and the sub-committee on cemented carbides of ASTM.

**Douglas P. Ferguson,** formerly chief metallurgist of the Wilson Foundry Division, Willys Motors Inc., Pontiac, Mich., has been appointed ferrocarbo engineer in the abrasive engineering department of the Bonded Products and Grain Division of The Carborundum Company, Niagara Falls, N. Y.

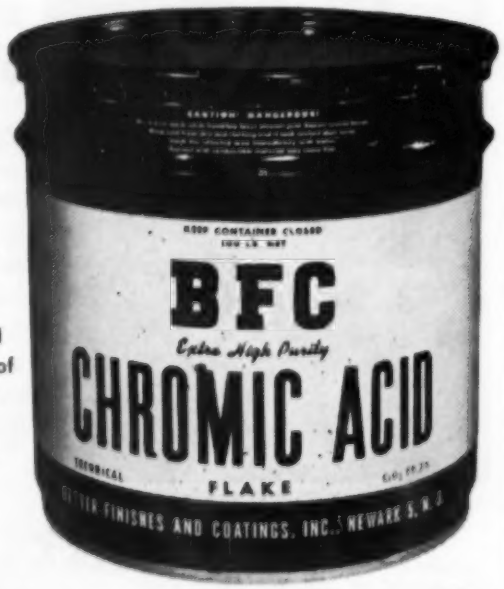
As ferrocarbo engineer for Carborundum, Ferguson will specialize in metal additives engineering services to the steel and foundry industries.

Ferguson received the degree of Bachelor of Metallurgical Engineering from Rensselaer Polytechnic Institute in 1947, and did advanced study in metallurgy at the University of Michigan.

He was successively plant engineer and metallurgist for Neehan Foundry, Neehan, Wisc.; metallurgist with Dearborn Specialty Foundry of Ford Motor Company; and then chief metallurgist for Wilson Foundry Division of Willys Motors, the position he held prior to becoming ferrocarbo engineer for the Carborundum Company.

**George P. Hutnick** has been appointed salesman for United Buff Products Corp., covering East Pennsylvania, and lower New York State. He comes to United Buff with more than eight years' experience in buffing and polishing of all metals. Hutnick is equipped to work with the customer right on the spot, and iron out any problems.


99 75+% PURE
CHROMIC ACID
TECHNICAL GRADE—FLAKE

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# Mail Box

October 22, 1954

The Editor, PLATING

DEAR SIR:

I have read the list of Reference Publications on Electroplating in PLATING, October 1954, p. 1200, with some disquiet. Surely such a list, if published at all, should be a little more complete and up-to-date. You do, after all, say that "it is intended to include the more commonly used references." No one would claim that you should include all the textbooks and journals on the subject, yet perhaps in a future case you might draw N. B. S.'s attention to such really notable omissions as:

*Books* (English language)

*Handbook of Industrial Electroplating*, Ollard & Smith

*Chemical and Electrolytic Polishing*, H. Silman

*Bright Plating and Electrolytic Polishing*, S. Wernick

*Metallic Corrosion, Passivity and Protection*, U. R. Evans

*Analysis of Electroplating and Related Solutions*, K. E. Langford

*Protection and Electrodeposition of Metals*, Dept. of Scientific and Industrial Research, England

*The Principles of Electrodeposition*, S. Field

*Foreign Language Books*

*Galvanotechnik (the old Pfanhauser)* (still the most comprehensive book on plating available)

*Werkstoff Aluminium und Seine Anodische Oxidation*, M. Schenk

*Metall Farbung*, H. Krause

*Le Polissage Electrolytique*, Vol. I, P. Jacquet

*Die Phosphatierung*, W. Machu

*Periodicals*

*Metalloberfläche*

*Zeitschrift für Elektrochimie*

*Metall* (about one-half concerned with metal finishing)

And our humble selves, which also contains Metal Finishing Abstracts (complete with world coverage of literature and patents)

I, and no doubt you too, could go on for another couple of pages, particularly if you would include items on the same level as some in the N. B. S. list. But, as you will see yourself, I have only mentioned books which are really recognized as standard works and periodicals which, modesty aside, may well be regarded as "a commonly used reference."

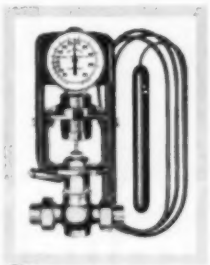
Yours faithfully,

ROBERT PINNER Technical Editor
Electroplating and Metal Finishing
85, Udney Road, Teddington, Middx

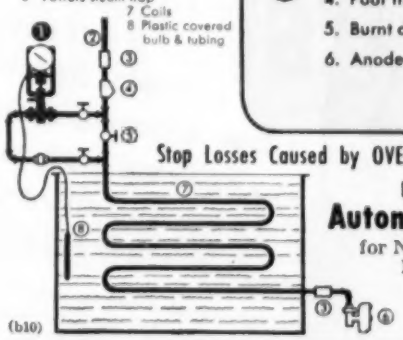
EDITOR'S NOTE: To "periodicals" above we feel we must add "Products Finishing," Ezra Blount, editor.


POWERS CONTROL

FOR ALL METAL FINISHING PROCESSES



1 POWERS No. 11MF Self-Operating TEMPERATURE INDICATING REGULATOR
2 Steam or water supply
3 Rubber hose insulators
4 Powers self cleaning strainer
5 Quick warm up valve
6 Powers steam trap
7 Coils
8 Plastic covered bulb & tubing



(b10)

2

POWERS

TECHNICAL DATA SHEET

NICKEL

*If you plate — NICKEL*
*Too high a temperature can result in:*

1. High consumption of organic addition agents
2. Rapid accumulation of organic decomposition products
3. Dull plate
4. Peeled deposits
5. Excessive evaporation

*Too low a temperature can result in:*

1. Dull plate
2. Low limiting current density
3. Peeled deposits
4. Poor throwing power
5. Burnt deposits
6. Anode polarization

Stop Losses Caused by OVER and UNDER Heated Plating Solutions

INSTALL POWERS
Automatic Temperature Control

for Nickel Plating tanks and other Metal Finishing Processes. It quickly pays back its cost by accurately holding solutions at a *constant uniform* temperature.

• THE POWERS REGULATOR COMPANY •

Skokie, Ill. • Offices in Chief Cities in U.S.A. and Canada • See Your Phone Book

Send this Coupon Now
FOR FULL INFORMATION

THE POWERS REGULATOR CO.
3400 OAKTON STREET, SKOKIE, ILLINOIS

☐ Please send Bulletin 330 and Prices on Powers No. 11-MF Temperature Regulator for _____ (Print name of process or type of plating)

☐ Send Bulletin and Prices on Temperature Control for:
☐ Heat Exchangers ☐ Washers ☐ Degreasers

Name _____ Title _____

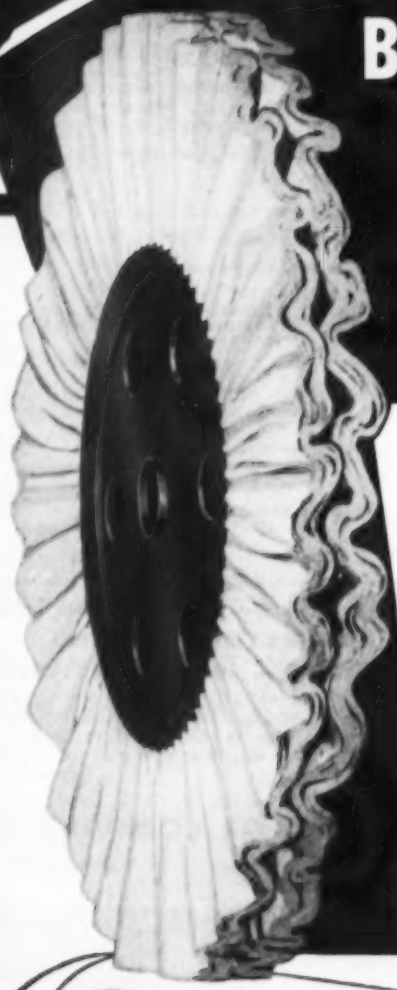
Company _____

Address _____

(b10)

# New SCHAFFNER BIAS buffs

## give more mileage ...



*because*

- ... FULLY VENTILATED
- ... COOLER RUNNING
- LOW COMPOUND CONSUMPTION
- ... FEWER SECTIONS NEEDED
- ... GIVES LONGER LIFE
- ... LATHE FACED AND BALANCED

Manufactured and controlled in our own new modern up-to-date Buff plant. Can be tailor made for your toughest buffing problem

MADE BY THE MANUFACTURERS OF FAMOUS AND ACCEPTED SCHAFFNER NO NUBBIN BUFFING COMPOSITIONS.

**Schaffner**
manufacturing company, inc.
SCHAFFNER CENTER • EMSWORTH, PITTSBURGH 2, PA.

CLIP TO YOUR LETTERHEAD

Phone ROsewood 1-9902

Please send me catalogue and complete information:

NOW PRESENTLY USING _____ Name, Manufacturer and Code No. of Buff _____
DIAMETER _____ CENTER SIZE _____
CENTER SIZE _____ ARBOR _____
PLY _____ COUNT _____
NORMALLY I USE _____ SECTIONS PER MONTH _____
NAME _____ TITLE _____
COMPANY _____ STREET _____
CITY _____ ZONE _____ STATE _____

SCHAFFNER AIR-COOLED METAL-CENTER BUFFS ARE PRICED RIGHT • PRODUCED IN ALL DIAMETERS, CENTERS, PLYS AND COUNTS

# STOP!

## Eliminate that Nubbin tax

Try .. **Schaffner**

# NO NUBBIN BUFFING COMPOUND

**For Automatic - Semi - Automatic - Hand Machines**

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manufacturing company, inc.

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Quick! Send me information and samples on NO NUBBIN Compounds

NAME _____ TITLE _____
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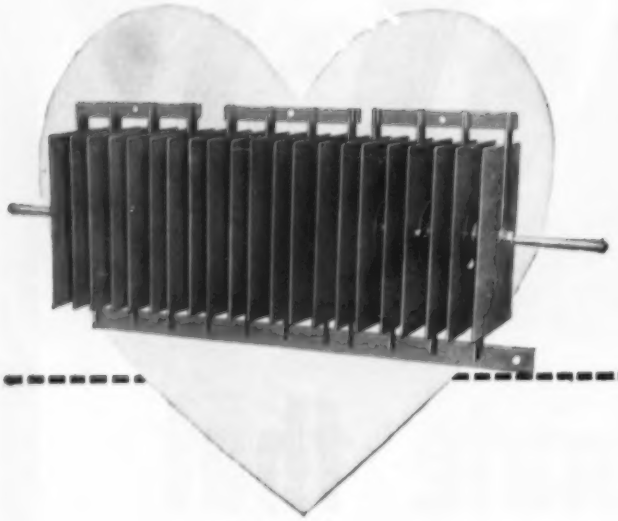


# Six Square Inches per Ampere* of "Heart"!

**The selenium stack is the heart of any selenium rectifier. For it is the quality of the stack and its accompanying circuitry that determines the effectiveness of a rectifier, just as the state of the heart and blood vessels of a human determine his strength and health.**

**IT'S A PROVEN FACT, RAPID RECTIFIER STACKS STAND UP LONGER IN HARD SERVICE. HERE'S WHY:**

1) Rapid allows 6 square inches per ampere of plate surface in full wave bridge circuits. For years we have maintained this standard (somewhat higher than other makes), since we feel allowing this much area results in maximum life expectancy.
2) The plates in Rapid stacks use triple purified Selenium.
3) They are carefully tested and balanced for even current distribution.
4) They are coated with an exclusive material rendering them absolutely impervious to the corrosive conditions existing in plating rooms.
5) The plates are spaced an average of ½ inch, diminishing the possibility of dust, dirt and corrosive material becoming lodged between plates, thus allowing heat to dissipate readily.

Rapid designs its stacks to much higher standards than most other manufacturers.**

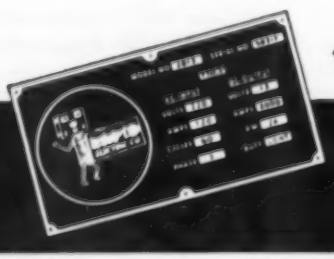
For example:

In tests performed at ambient temperatures of over 30°C, a recognized electrical manufacturers' group standard allows a temperature rise in the stack of 60°C; and, a rise of 40°C at the same ambient temperature for 1000 hours is permitted without derating.

Rapid standards permit a maximum stack temperature rise of only 22°C above the ambient. This low rise is made possible only because of the large area used per ampere, the plate spacing, high purity of Selenium used, the advanced circuitry and the engineering skill which designs the complete rectifier unit for the specific job.

So, when you buy a rectifier, check its heart. Make sure the one you buy offers the most advanced design for longest life . . . In other words, make sure you get a Rapid Rectifier.

*In forced air cooled, three phase, full wave bridge circuit units.
**All three phase rectifiers are designed with a full wave circuit.



THE NAMEPLATE THAT MEANS *"More Power to You!"*

## RAPID ELECTRIC COMPANY

2881 Middletown Road • New York 61, N. Y. • Phone: Talmadge 8-2200

# Industry News

**Automation Needs Bold Handling.** Automation's rewards can be best realized if management boldly experiments with new techniques and equipment and refuses to let its attention be diverted to the immediate details of mechanism and men, an industrialist recently declared.

"Does automation seem applicable, and will it introduce economies?" That, said George M. Muschamp, is the basic question which should dominate consideration of these new developments. To take full advantage of automation, he added, requires "a tolerance of so-called novelty and theory."

**International Agreement.** An agreement designed to bring the latest product and design developments of the porcelain enamel business to the growing Canadian economy was announced jointly today by Graham Bell, Ltd., Streetsville, Ontario, Canada, and the Bettinger Corporation of Waltham, Mass.

The agreement, which provides for close association between the two companies, will enable Graham Bell to produce and sell in Canada the many Bettinger designed products that have made the American company a leader in the porcelain enamel business. Graham Bell has already had evidence that a large amount of architectural porcelain enamel, a principal product of Bettinger, will be required to meet the needs of Canadian industrial and commercial building expansion.

To properly promote this new association, Graham Bell has undertaken a public offering of its common stock. The proceeds from the offering will be devoted to carrying the anticipated increase in sales and advertising and sales promotion expenses. In addition, under the supervision of Bettinger, funds will be allocated for research and equipment purposes, including new enameling furnaces.

The Bettinger Corporation will be the largest single stockholder in Graham Bell. The Board of Directors of Graham Bell will include officers of the company and officers and representatives of Bettinger.

The porcelain enamel business in America within the past three years has increased its volume considerably because of new industrial and architectural uses, many of which were pioneered by Bettinger.

The new association with Graham Bell will enable Bettinger to broaden the market for its products which are now being manufactured in this country by three plants located in Waltham, Mass., Rehoboth, Mass., and Toledo, Ohio. Bettinger is headed by young management, including Robert A. Weaver, Jr., president; Arthur D. Shaver, vice-president and treasurer, and Fred D. Shaw, vice-president and general manager. The group assumed control of the company in 1947 and have in the past seven years increased its sales more than six times.

Graham Bell is one of the growing Canadian producers of porcelain enamel on steel. It was founded by three men: P. Graham Bell, president; George Burton and Joseph W. Axon, both vice-presidents, all of whom had previously been associated with a large metalworking firm.

**Sale Announced.** At Los Angeles, sale of the Chainveyor Division of the United States Spring & Bumper Co. to the Chainveyor Corp. has just been announced.

The new corporation consists essentially of the former staff and operating personnel that guided its destiny at United States Spring & Bumper Co.

Patrick T. Rauen, formerly vice-president of United States Spring & Bumper Co., is president of the new corporation; Loren F. Working, for many years vice-president and general sales manager for Clayton Manufacturing Company, and more recently manager of the Chainveyor Division at United States Spring & Bumper Co., is vice-president and general manager; Ames E. Arnold is secretary-treasurer; and Charles L. Long remains in charge of production.

**George Benda Bronze Powder Works 130 Years Old.** One of a scant handful of companies in this country more than


Hammond
of KALAMAZOO
FOR THE RIGHT FINISHING HEAD

Totally enclosed fan-cooled motor (3 and 5 HP, 1750 RPM and 7½ HP, 3450 RPM).

Sturdy steel column with 14" vertical movement.

Handwheel with ball thrust bearing for easy verticle column adjustment.

Reversible ratchet wrench operated dovetail slide feeds wheel to work on "once set-always set" angled head.

Multi-V-belt drive permits various spindle speeds.

Large, extra heavy cast-iron base with anchor bolt holes.

MODEL 50-81

1½ HP to 25 HP — Floating or non floating types for use with buffs, wire or tampico brushes or abrasive belts. Accessories include AIR LIFT — POWER WHEEL FEED — POWER TRAVEL (VERTICAL OR HORIZONTAL) OSCILLATING SPINDLE. Tell us your problem and let us quote on your requirements.

Hammond Machinery Builders INC.
1613 DOUGLAS AVENUE KALAMAZOO, MICHIGAN

## Industry News

a century old, George Benda, Inc., manufacturer of "Bendalin" custom quality bronze powders, marked its 130th year of continued operation and its 52nd year in this country in December.

Founded in 1824 at Nuremberg, Germany, the company was moved to the United States in 1902 and its plant and offices were established at their present location in Boonton, N. J. Control of the company was acquired by T. J. Hillery, Sr., in 1919 and has remained in the Hillery family since then. The president of the company is Mrs. B. A. Hillery. Management of the Benda operations is by New Jersey State Senator, T. J. Hillery, Jr., vice-president and treasurer, and J. A. Cooney, secretary and plant manager.

Benda operations of today combine modern machinery and laboratory equipment with techniques as old as the ancient craft of gilding with gold leaf, copper and the earliest bronze alloys. The latest ball mill units operate side by side with stamping machine methods that are only a few steps beyond the goldbeaters' skin and ponderous hand hammer.

**Sustaining Memberships**

Three more organizations have joined the AES Research Sustaining Membership program. The new members are:

**Reliable Plating Rack Co.**
**Schiller Park, Ill.**

**Kaybar, Inc.**
**Hazel Park, Mich.**

**National Rejectors, Inc.**
**St. Louis 15, Mo.**

**Westinghouse Sees Unlimited Air Conditioning.** Air conditioning was described as America's fastest growing industry with "almost inexhaustible markets" still barely scratched.

John A. Gilbreath, manager of the Westinghouse air conditioning division, also forecast that sales of air conditioners for commercial, industrial and residential use will soar 1,000 per cent in the next 10 years. Gilbreath and William B. Cott, sales manager, led a group of Westinghouse executives who came to Pittsburgh, Pa., from Staunton, Va., for a conference of distributors and dealers in the company's central region.

**Honeywell Opens Research Center.** A new research and product development center has been opened in Denver, Colo., by Micro Switch, a division of Minneapolis-Honeywell Regulator Company, it was announced recently by W. W. Gilmore, president of the division.

The new center will supplement research activities conducted at the division's main office and factory in Freeport, Ill. Wilbert Martin, assistant director of product research and development, will be in charge of the new facility. About ten engineers and technicians will be employed.

According to Gilmore, the new Denver office will provide improved engineering and product development service for users of precision snap-acting switches. Its establishment, Gilmore said, is part of a planned program aimed at improving the materials used in switches and developing new principles and methods of switch operation to meet present and anticipated needs of electric current control in industry and aircraft application.

(*Continued on page 135*)


THE ANSWER TO YOUR TANK HEATING PROBLEMS

FOR ACID HEATING JOBS

G SERIES
FUSED QUARTZ
IMMERSION HEATERS

Over 40,000 CLEPCO Fused Quartz Heaters now in service.

Dependable, controlled heat at low operating cost.

Wide range of Standard Sizes for every need.

Only Fused Quartz Heater recommended and sold by all leading plating supply houses.

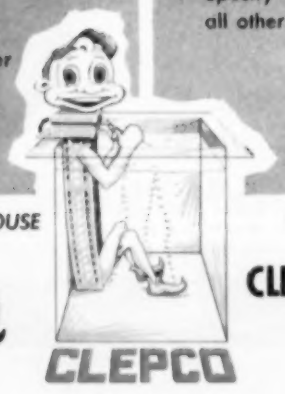
FOR ALKALINE HEATING JOBS

W & WS SERIES
STEEL AND STAINLESS
IMMERSION HEATERS

Specify CLEPCO Non-Magnetic Stainless Steel Heaters for your alkaline electro cleaners and bright copper plating tanks.

Specify CLEPCO Steel Heaters for all other alkaline tanks.

All leading Plating Supply Houses can furnish from stock.




SEE YOUR PLATING SUPPLY HOUSE

Clepco

WRITE US FOR LITERATURE

CLEVELAND PROCESS COMPANY
1965 EAST 57th STREET
CLEVELAND 3, OHIO

## *The Cover*

### A Flexible Plated Circuit

At about the time of the beginning of World War II, radio was in a state of static doldrums. Television had been introduced and withdrawn. Radar was an experimental monstrosity in England. VHF was just starting its first tentative uses. UHF was an idea of the theoreticians.

Then, under the impetus of war, there was need for fast application of known principles and direct use of every possible laboratory "toy." Radio, radar, VHF and UHF sets had to be made light enough to be mobile and to be carried by war planes. Radar had to be installed in small trucks and set up anywhere. The need for miniaturization was obvious.

In the electronics industry tremendous strides have been made in relatively short time. This is true in the fabrication and planning of sets as well as in the use and adaptation of electronics to navigation, entertainment, controls, industry, etc.

In the improvement and miniaturization of sets, many ideas and methods have been devised. Among these the circuit pictured on the cover is one. This one was deposited by making use of plating techniques.

Ed Bowerman of Sylvania Electric Products, Inc., through whose courtesy the picture is used, describes it thus:

"We are dealing with an adhesive wiring harness applicable to plastic or other insulated surfaces. At present, a good deal of competitive processes use electroformed sheet copper as their starting material. In these processes, surplus copper is removed by die cutting or etching. The sheet copper is then adhered to plastic sheets.

"In this case we produce the circuit by electrodeposition on stainless steel and back it up with adhesive. One modification eliminates the transfer of the polyvinyl resist and produces a flexible plated wiring which is adhesive to the components to be installed. In a number of applications, the cloth backing is slightly shorter so that the copper extends beyond the adhesive permitting direct connection by riveting or soldering."*

In short, this and many another application of plating processes and methods serve the electronic industries. The surface has not yet been scratched, however, since electronic uses grow with each passing day. This is, in fact, an infant industry and a relatively new science. Plating methods and processes should move with it and add immeasurably to the growth and application of electronics.—Ed.

*See: "A Flexible Plated Circuit" by E. R. Bowerman and R. F. Walton, PLATING, July 1953, pp. 765-766.


# CHURCHILL FINGER-BUFF*

## #150 DN

## *Developed specifically*

## FOR BUFFING COPPER

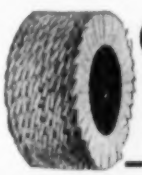
**#150 DN**
**Ideal for Copper and like metals**
**Exceptionally fast cutting action**
**—no streaking**

Developed specifically for buffing copper. Each section of this Churchill Type #150 DN is made with a double row of overlapped and staggered fingers. This specialized construction gives a continuity to the working face of the buff for smooth operation.

In addition, the buff fingers of the adjacent sections meld and fit compactly together. Thus, the #150 DN absolutely eliminates all streaking and gouging and gives the best finish obtainable on copper.

If you are buffing copper or like metals, we believe these #150 DN Churchill Finger-Buffs* merit a trial in your buffing room.

- Churchill Finger-Buffs* are competitively priced. Produced in all sizes from 6" to 18" diameters. For complete information write your problem.



**Geo. R. Churchill Co., INC.**

CHURCHILL FINGER BUFFS*

*Trade Mark Reg. U. S. Pat. Off.

Representatives in Principal Cities

FREE Catalog

Geo. R. Churchill Co., Inc., Hingham, Mass., Dept. P
Please send me FREE catalog and complete information.

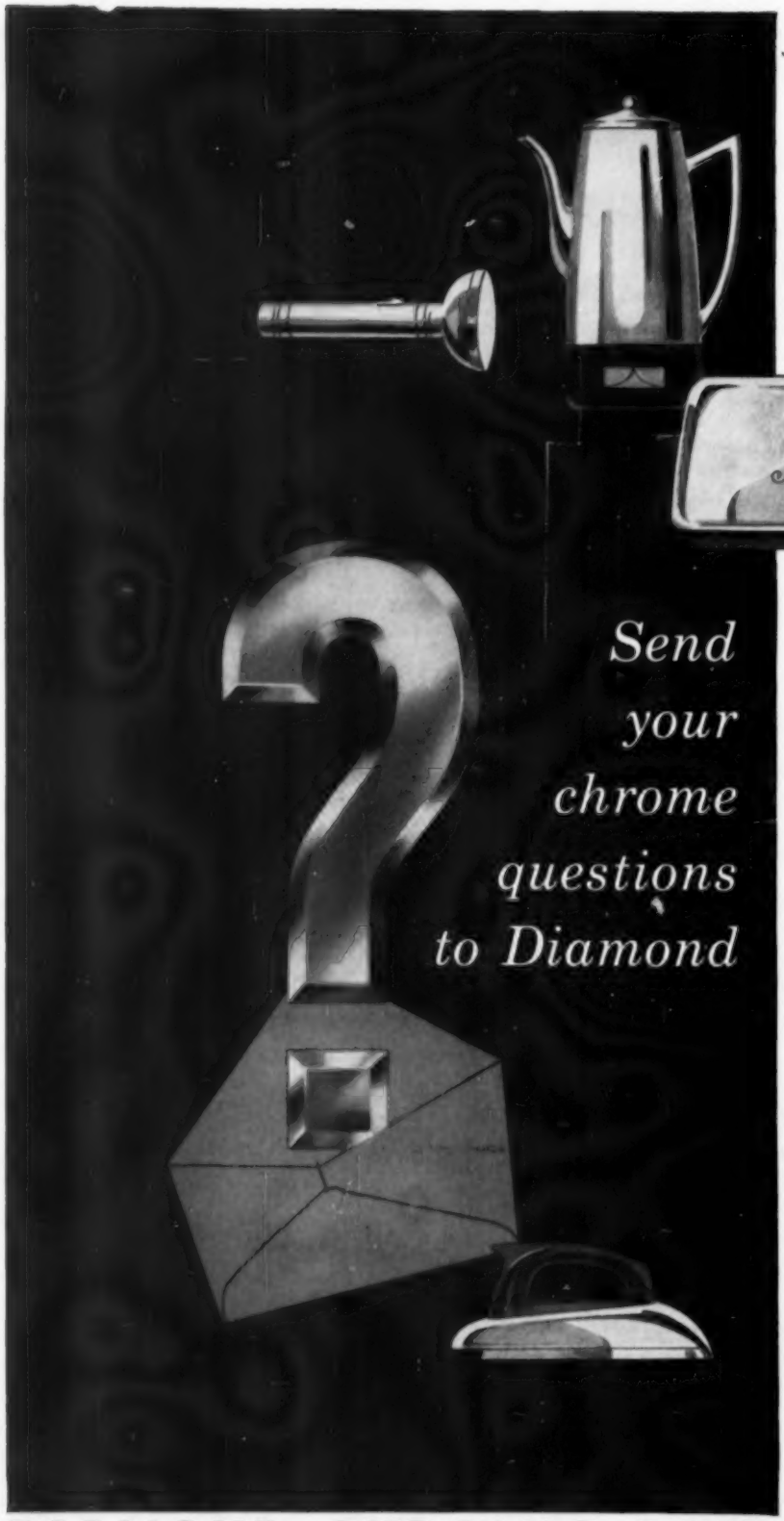
- My special buffing problem is .....

Name ..... Title .....

Firm .....

Street .....

City ..... Zone ..... State .....




DIAMOND CHROMIC ACID

If you have a problem connected with chrome plating, bring it to DIAMOND. Our Chromium Chemicals Division is set up to handle your questions . . . completely and quickly. Our technical specialists can draw on a broad technical background plus extensive research and test facilities . . . all you have to do is ask.

The answers you'll receive carry the weight of broad experience for no manufacturer controls more steps in the making of Chromic Acid. DIAMOND experience and know-how go right back to making the soda ash and importing the chrome ore and includes every step through production and delivery, right up to standing by your side, if you wish, to help you get uniform, high-quality plating results.

Nine warehousing points and sales offices across the country assure you fast service, uninterrupted supply. DIAMOND ALKALI CO., 300 Union Commerce Bldg., Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS ®

## *Industry News*

(*Continued from page 132*)

**Honeywell Buys Doelcam.** Minneapolis-Honeywell Regulator Company has purchased all of the outstanding capital stock of Doelcam Corporation of Boston, Mass., manufacturer of precision instrument and control equipment for aircraft and industry uses, Paul B. Wishart, Honeywell president, announced recently.

The Boston firm, employing more than 600 persons, designs and produces such precision devices as synchro motors, gyroscopic instruments, precision electromechanical servo components and electronic control and test equipment. Many of these products are used in military applications such as bombers, navigation computers, fire control systems and missile stabilization and guidance systems.

**Industry, Nation's Biggest Educator.** According to a poll of industrial, college and business association leaders, approximately half of the nation's 60 million workers are engaged in some kind of training. This training consumes something like 5 to 10 billion man-hours and has been estimated to cost about $10,000,000 annually. It ranges from apprentice programs to college-type courses.

**Lithium Corporation Announces Staff Additions at North Carolina Plant, Bessemer City.** The following changes and additions to the engineering and production departments at Lithium Corporation of America's Bessemer City, North Carolina plant have been announced. From the Company's St. Louis Park, Minnesota plant: J. D. Herman, project engineer; R. L. Nielsen, chief design engineer; H. J. Andrews, assistant design engineer. From the company's Hill City, South Dakota operations; Gerald A. Munson, general manager; Daniel D. Michalek, geologist. New additions to staff: Fred A. Dixon, buyer, from Marlowe, Inc.; Robert H. Smith, audit clerk, from Northern Chemicals, Ltd.; Edward F. Golob, chemical engineer, from U. S. Bureau of Mines; J. W. Setzer, chemical engineer, from the Utilities Department, City of Gastonia; R. E. Jurkovski, electrical engineer, from Langford Electrical Company, Minneapolis, Minn.; C. J. Vanderbilt, mechanical engineer, from Lospe & Fredericksen, Milwaukee, Wisc.; Joseph N. McClure, mine superintendent, from W. L. Hailey & Company, Nashville, Tenn.; Clyde H. Robinson, assistant geologist, from military service.

Construction on the new $7,000,000 plant is proceeding on schedule, and production is expected to begin early in 1955.

**Norton To Build New Plant.** Norton Company, Worcester, Mass., will add to its electric furnace capacity by building a new plant in Huntsville, Ala., Milton P. Higgins, company president, announced today.

This expansion of Norton's electric furnace facilities located since 1910 in Chippawa, Ontario, will be situated on a 100-acre site in an area known as Hobbs Island along the north bank of the Tennessee River.

Completion of the plant is expected by the end of 1955. Total cost of land, buildings and equipment is estimated to be $1,250,000.

The new plant will produce Magnorite refractory grain (fused magnesia), fused zirconia, Norbide refractory grain (Morton boron carbide), and special products for the Atomic Energy Commission. Each of these products is finding greater application daily in the metals, chemical, ceramic, heat and power, and electrical industries. It is likely that Norton may also manufacture crude aluminum oxide and silicon carbide there at a later date.

**New Sales Representative for Shriver.** T. Shriver & Company, Inc., of Harrison, N. J., announces the appointment of The Watts Company of Houston, Texas, as its executive sales representative for Shriver equipment in southeast ern Texas and all of Louisiana, with the exception of the sugar industry.

T. Shriver & Company, Inc., with executive offices and plant situated at Harrison, N. J., are manufacturers of filter presses, diaphragm pumps and hydraulic accessories.


MAINTENANCE COSTS *dip*

When you insulate with

TYGON 277 *Air-Dry* RACK COATING

This new "higher-solids-content" rack coating builds up a thickness of five mils per dip — four easy dips instead of the seven usually needed to build a safe 20 mil coat — cuts rack handling time almost in half. This higher-solids-content means a denser, less porous coating, — safer, more efficient, longer-lasting protection.

Tygon 277 requires no primer, it is self-adhering; requires no baking, it air dries quickly; requires no laborious application techniques, just dip and air-dry—that's all.

Place a trial order for a gallon today. Check it against the best you've known. You'll go Tygon 277 all the way.

*Plastics and Synthetics Division*

2760

U. S. STONEWARE

AKRON 9, OHIO

# Trade Literature

**Please use Reader Service Card to obtain any item in this section**

**L—227. Vapor Spray Degreasers**—A bulletin dealing with the features of Ramco vapor spray degreasers has been issued by Ramco Equipment Corp.

Among the many features detailed in this bulletin are the following: noncorrosive stainless steel troughs, lifetime corrosion-proof stainless steel condensing coils and one-bolt action doors.

A cross-section illustration of the design of Ramco vapor spray degreasers graphically points up the performance of these machines.

A table showing eight popular, standard Ramco models provides information regarding working space, over all dimensions, heat requirements, and solvent capacity

**L—228. New Catalog Issued by General Industrial Co.**—A new and colorful catalog has just been published by the General Industrial Co. Many new items have been added to General's standard line consisting of steel shelving, lockers, storage cabinets and intercommunication systems. Offered in a wide variety of sizes and capacities are the plastic drawer cabinets which are ideal for small tools, nails, etc. Each item is clearly illustrated and priced.

Each of U. S. Stoneware's many products for platers has been developed with two thoughts kept constantly in mind: (1) to lower plating costs, (2) to improve plating quality.

Designed and developed by engineers and chemists expert in the selection and use of corrosion-resistant materials, "U. S." products for platers have been field-tested, field approved.

Feel free to consult U. S. Stoneware plating specialists without obligation. Their rich background of experience may be of help in solving many of your plating and finishing problems.

*Engineers, Manufacturers, Erectors of Corrosion-Resistant Equipment Since 1865*

See Your PLATING SUPPLY DEALER or Write Direct

PLASTICS & SYNTHETICS DIVISION
U. S. STONEWARE
Akron 9, Ohio

65C


**L—229. Plastic Closures Folder**—To informatively present its expanded line of CaPlugs (Polyethylene closures), Protective Closures Co., Inc., sends a newly published illustrated file folder and a representative assortment of samples to those inquiring.

Safeguard

Describing fully and concisely the complete CaPlug line of threaded and nonthreaded caps and plugs for safeguarding products in process, storage and transit, the folder is tabbed and punched for easy filing and finding in either binder or cabinet. Enclosed in the folder are complete price lists for over 100 stocked sizes of the five standardized designs used to protect tubing, fittings, valves, hydraulic components and numerous machined parts.

**L—230. NesTier Case Study No. 1**—The Chas. Wm. Doepke Mfg. Co., Inc., announced the publication and availability of NesTier Case Study No. 1. This new illustrated brochure is the first in a series of methods improvement studies analyzing actual installations to show how NesTier small parts handling equipment cut costs and increased production.

Case Study No. 1 is a before-and-after articulation of an assembly operation at NuTone, Inc. This Cincinnati manufacturer of door chimes and kitchen ventilating fans indicates a 35 per cent increase in production at this assembly station through utilization of the NesTier system. This new comparison study gives detailed analyses of the various operational elements included in the assembly procedure. It shows how NesTier small parts handling boxes and Hopper Rack Assemblies increased production by making the component parts more readily accessible to the worker and by eliminating rehandling of parts at the assembly bench. Statistical breakdowns of times for each element of the operation provide a striking contrast between the old and the new method. Thus, the reader can reach conclusions relative to the savings possible in similar situations with NesTier equipment.

In addition to the production increase realized at one work station, the study points out that 20 per cent of all other parts handling operations have been eliminated through conversion to the NesTier system.

**L—231. Time-Pattern Transmitters**—Specification 287-1 lists complete specifications of the Brown Pneumatic Time-Pattern Transmitter Unit, an instrument which positions the set point indices of one or more instruments according to a definite time-pattern.

*Automatic*
**BIAS SISAL BUFF**

Over-square, self-centering, cost-producing conventional types. Eliminate messy grease wheel operations. Available in air-cooled Permagaged Center or patented Cementless construction.

*Automatic*
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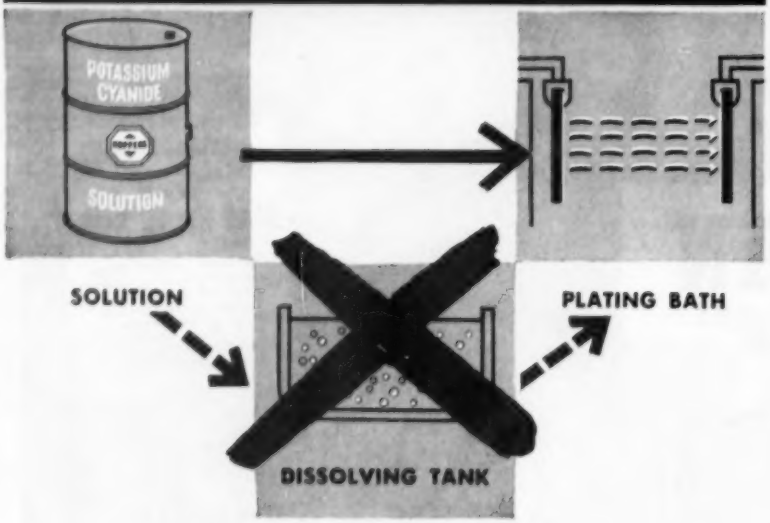


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## *Trade Literature*

**L—232. Die Handling Trucks Literature**—Details of its new line of hydraulic die handling trucks are contained in new literature available from The Elwell-Parker Electric Co., Cleveland, Ohio.

The trucks, because of their unique design, are able to perform numerous die handling operations with advantages never before possible. Two hydraulic cylinders are located along the sides of the truck's platform and transmit power independently to pusher bars by means of a pair of roller chains recessed in the surface of the platform.

The pusher bars are operated independently, thus making it possible to turn the die as it is pushed off the truck. Also, the hydraulic power permits a die to be slowly and precisely positioned on a press bed without the sudden starts and stops so often associated with electrically operated controls.

Likewise, the low height of the truck platform when in its base position facilitates the servicing of bed presses with exceptional ease and speed.

**L—233. Barrel Finishing Techniques and Products Booklets**—Two new booklets describing barrel finishing techniques and products have been published by Minnesota Mining and Manufacturing Co.

One of the publications, "Barrel Finishing," explains how barrel finishing works, what types of parts can be barrel finished, and what operations barrel finishing performs.

It contains an illustrated case history section pointing out how manufacturers of many types of parts are increasing production and cutting unit costs by barrel finishing, and it lists materials needed for the process.

**L—234. Bulletin on Protective Atmospheres**—A new bulletin describing the use of protective atmospheres to prevent deterioration of metals during various heat-treating processes has been announced as available from the General Electric Company, Schenectady, N. Y.

Designated as GEA-5907, the 12-page publication explains G-E's four basic types of gas-producing equipment which meet most protective atmosphere needs. Case histories illustrate the savings to be made in different types of jobs. Two tables are included, one a selection guide to help choose the correct protective atatmosphere for each job and the other explains the approximate compositions and costs of producing typical protective atmosphere gases.

# REPORTS
## from all over
### . . . stripped, cleaned and degreased

*(This section is especially compiled for the readers of PLATING; here the world in which we work and operate is stripped of its veneer, cleansed of its distortions and carefully degreased of superfluities).*

The U. S. economy in general enjoyed its second best year ever. The gross national product—the sum of all goods and services produced—reached $356 billion in 1954. This is only 2½ per cent below the record $365 billion in 1953.

**METALS**—Standard output showed a 21 per cent decline from the record level achieved in 1953. Domestic mills polled 88,200,000 tons in 1954 compared with the record 111,609,719 tons the year before. 1955 should show strong gains and a return to the 100,000,000 ton mark. Forecasts in steel circles run as high as 112,000,000 tons. . . . **NICKEL**—The report of the NAMF shows a continuing investigation into the tight nickel situation and the government-in-business fight goes on. The Air Force claims great advantages in the depot maintenance function of electroplating. . . . Japanese and French sources of nickel accounted for 1,500,000 pounds as contrasted with shipments from regular suppliers of about 180,000,000 pounds. The French and Japanese nickel sold for as high as $2.50 per pound as contrasted with the normal price of 60 cents (the present price of Japanese and French nickel is between $1.12 and $1.25 per pound). Nearly all this premium price nickel has been purchased for use in electroplating for passenger automobiles. . . . **ALUMINUM**—The 1954 output of 2.5 billion pounds topped that of 1953 by 16.7 per cent. . . . The electroless nickel plating process is becoming increasingly popular as a method of applying a wear resistant surface to aluminum aircraft parts. . . . **TITANIUM** extrusions for the aircraft industry are being made in sizes, shapes and tolerances just like those of standard aluminum extrusions.

**LABOR**—Two major goals dominate labor's 1955 horizon—one is the guaranteed annual wage; the other is unity within its own ranks. . . . Several unions used paid-up funds paid in as dues or welfare contributions to make corporate investments during 1955.

**CORPORATIONS**—Improved corporate profits are expected in 1955 over 1954. Earnings, however, are not likely to increase more than 5 per cent over the total of $18,000,000,000 for last year. Corporate and excise tax rates will continue at existing levels. The corporate income tax return in the present law declines from 52 to 47 per cent effective in April. Many corporations benefited from stepped up depreciation allowances for tax purposes under the 1952 Revenue Act and the expiration at the end of 1953 of the excise profits tax.

**THE OUTLOOK**—Good business will get better—but not boomy. Recent gains in **housing, cars,** and **steel** are spectacular, but the overall rise is moderate. Only two bad spots: slow loss in farm income and possible overbuilding of homes. . . . **Plant** and **equipment** expenditures will not decline. . . . **Capital spending** will remain about the same as last year with a possibility of an upturn. . . . **Employment** should rise with business activity, but unemployment will gain (the labor force is going up faster than the number of new job openings) but not more than 5 per cent. . . . **Total retail sales** should reach a new record high. . . . **Total production** will continue to rise to meet improving consumer demand and the need to restock inventories that were worked very low last year. . . . **Money supply** is up to 204 billion but even this amount is not quite adequate to meet the strong rise in demand for credit. . . . **Interest rates** have been firmed because of bigger demands for credit. No repetition of the "tight" money situation of last year, when interest rates rose sharply, is expected. . . . More private **foreign investments** n 1955. . . . **Color TV** will be held back until better tubes can ibe produced.

AD


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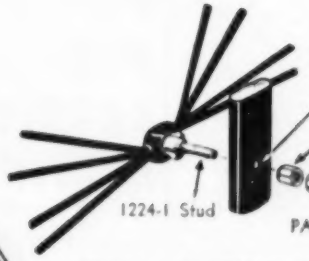


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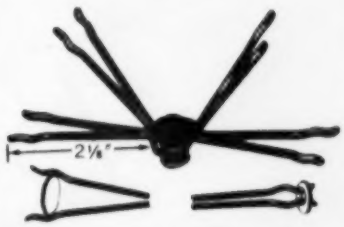
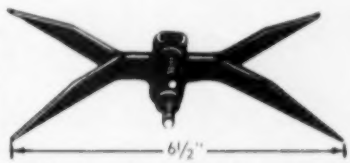
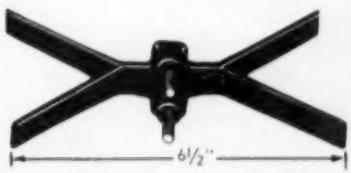



RS-207. Same design as the popular Style 1 Utility Tip. Has 8 prongs arranged in 4 pairs—formed to hold objects under spring tension from either inside or outside. Wire sizes: 1/16", .072" and .080". Universal Plastic Coated.




FS-102. Same design as the Style 4 Utility Tip, except has double knurler. 1/16" x 5/8" phosphor bronze. Universal Plastic Coated.




FS-101. Same design as Style 3 Utility Tip, except has double knurler. Excellent for racking objects that tend to wobble. Square ends are easily shaped when necessary. 1/16"x5/8" phosphor bronze. Universal Plastic Coated.

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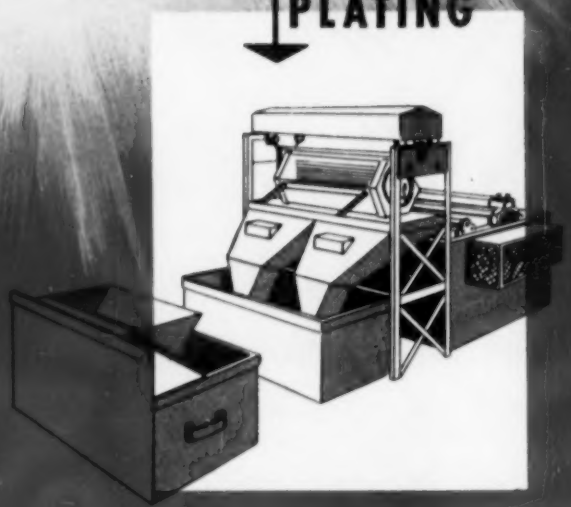

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### Savings

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*One manufacturer, formerly barrel plating small steel stampings with 2.5 amperes per gallon of solution, changed to Lea-Ronal Bright Copper and has been able to obtain brighter deposits with 6 to 7 amperes per gallon of solution.

Other advantages of Lea-Ronal Bright Copper for Barrel Plating are (1) excellent anode corrosion resulting in minimum metal cyanide addition; (2) bright, soft ductile deposits; (3) maximum bath efficiency with longer bath life (carbonate build-up not detrimental); (4) many items being racked and plated in still tanks can now be plated satisfactorily in barrels with Lea-Ronal Bright Copper.

Just as operators of still tanks have found Lea-Ronal Bright Copper (utilizing Lea Copper Glo) extremely worthwhile, so will you find Lea-Ronal Bright Copper for your barrel plating also much more effective than conventional barrel solutions and methods. Why not place a trial order and make your own comparisons?

Lea-Ronal Bright Copper for barrel plating (for which Lea Copper Glo is an essential ingredient) is marketed exclusively through The Lea Manufacturing Co., 16 Cherry Avenue, Waterbury 20, Connecticut. Your inquiry should be addressed to that company.

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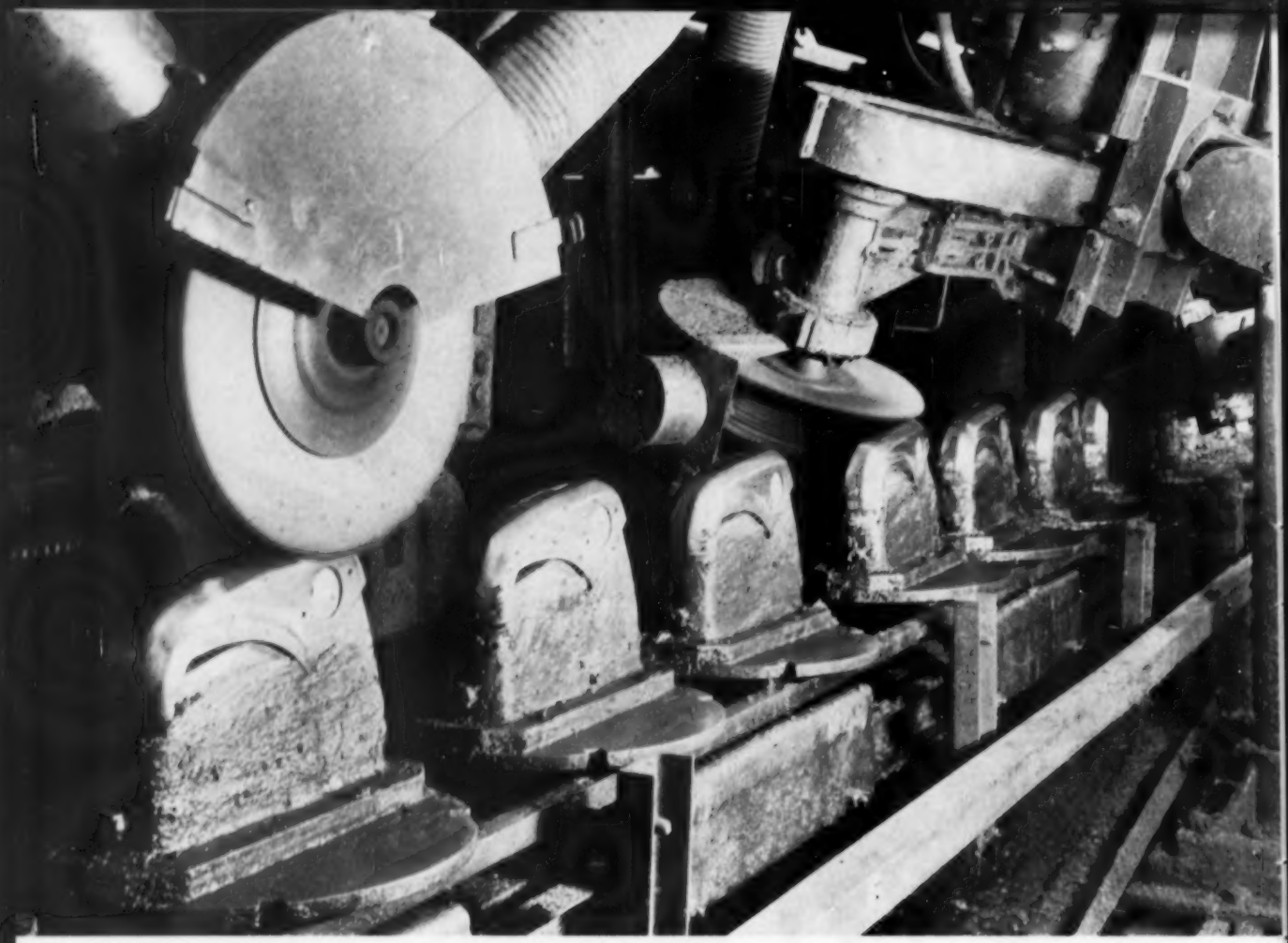


View of sisal brushing on automatic polishing machine

# Bumper Guards

## PROCESSING KNOW-HOW RESULTS IN SUPERIOR FINISHED PRODUCT

BY MAX WEINBERG AND AL LAKE*

THIS contribution is not intended to be startling or novel. Many fine papers have been written in more detail on various aspects of this paper. It is then intended to show in brief the processing of bumper guards as practiced in our plant utilizing a nickel strike instead of the conventional copper strike in the plating procedure.

The processing of bumper guards can be broken down into three main categories: (1) stamping, (2) polishing and (3) plating. Each of these is dependent on the other for its success and, therefore, each must be operated at its peak efficiency or the others may suffer because of the extra burden they may have to carry. The final cost of producing a finished bumper guard will therefore depend to a great extent on the success of the stamping, polishing and plating operations.

*Steel Procurement*

The steel when possible, is procured under specification. It must make the part, have a certain hardness, meet an Olsen test and have a good surface. The "cupping test" such as one gets on an Olsen machine is useful in showing the nature of the steel surface after it has received a severe draw. Some steel may appear to have a good surface but on making the part the steel will open up giving stretcher strain, "orange peel" or rough surface effect. This type of steel will usually require more finishing operations than a steel that does not open up.

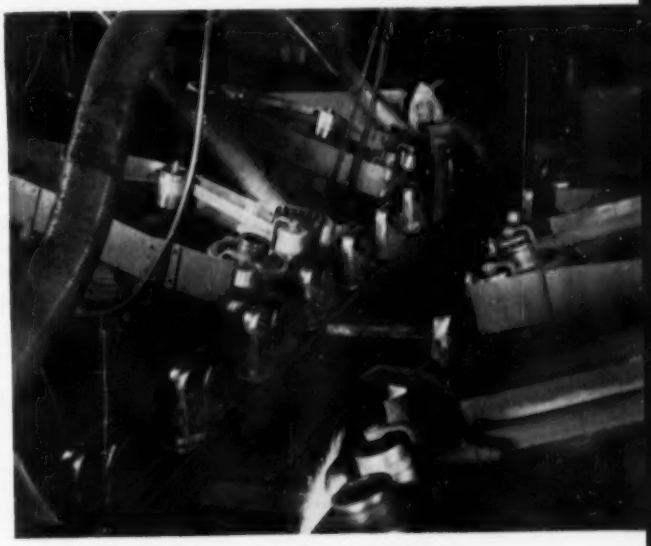
Usually for most metal finishing operations a fine grained stabilized steel such as aluminum killed steel is preferred. Since the grain size affects both the smoothness of the sur-

*Parker-Wolverine Division of the Udylite Corporation.

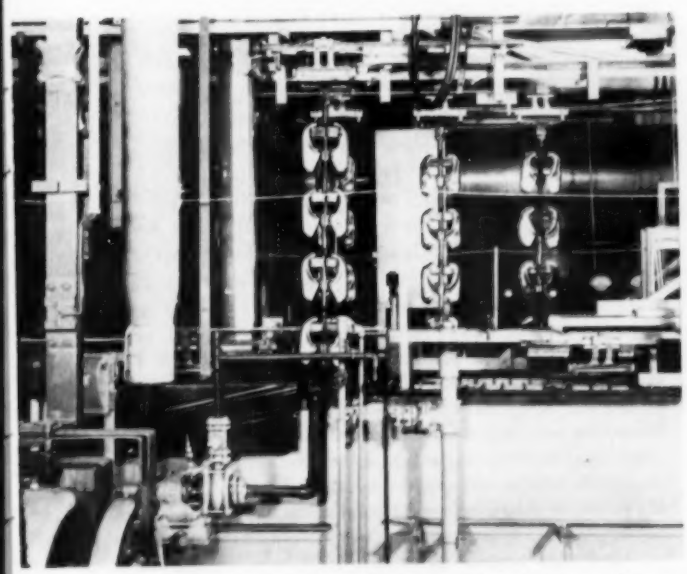
Forming—drawing operation of bumper guards

Automatic polishing operation

Trimming, automatic welding and attachment of inner plates



Automatic machine for "roughing"



Nickel strike section on automatic nickel chrome machine

Set-up of polishing wheels—part of wheel room

face of the drawn part and the hardness of the steel, a compromise on the fineness of the grain must often be used to satisfy both requirements of softness of steel and smoothness of surface. Therefore the best forming steel may not necessarily be the best steel from a finishing standpoint. Some fabricators may prefer a fine grained steel to insure against surface roughening, while others may prefer a softer steel to make the part with the fewest rejects. The type of steel used quite frequently is influenced by the design of the part, the design of dies for making it, the practice followed in the stamping plant and the particular steel mill from which the steel comes.

*Forming and Drawing Operation*

It is important on forming or drawing the part that the dies be in first class condition. Any die defects will show up in the stamping and necessitate additional polishing operations. It is preferred to have radii on all points and corners to prevent "treeing" in the plating operations. By the same token, any trimming operation should be from the outside in, so that the rough burr will be on the inside.

*Roughing*

After the parts have been made and properly trimmed, they are washed and ready for welding and the attaching of innerplates or bolts, if necessary. The rough surface left by welding or attachment of inner plates must be eliminated before any fine polishing can be done. This is usually done by a coarse or rough polish that removes the imperfections left by die scores, welding or other operations. Belt polishing is frequently used in this rough touchup or spotting operation.

*Polishing Wheels*

A good grade medium hard conventional cloth wheel is used. For rough polishing these wheels are set up using a cement and artificial emery, but for oil finish operations, the best hide glue obtainable and a select screened Turkish emery are used. As is well known, the preparation of the glue, heating to proper temperature, the humidity and cleanliness are important.

To clean a worn-out polishing wheel prior to reheading, a lump of pumice is used to remove every bit of grease possible. This is followed by stoning the wheel with a stick of carborundum. Another method used is to apply dry steam to the wheel as it revolves on a polishing lathe.

After cleaning the wheel, the next step is glue or cement sizing of the head. The wheel is then dried for several hours. This is followed with two heads of emery with drying time in between. A polishing wheel heading machine is used for the set-up work. This gives a more uniform application of emery, due to the constancy of the speed of rotation and the uniformity of the pressure applied. In preparing a polishing wheel for use, great care should be given to the balancing, breaking in of the wheel and the use of sufficient tallow.

*Polishing*

The polishing procedure outlined is the method practiced for the polishing of multi-shaped steel stampings preparatory to bright nickel plating. This should, normally, eliminate nickel buffing prior to chromium plating. In the last few years the restrictions on the use of nickel and the type of steel available have presented many problems. Stampings are preferred which are free from metal stretch, die scores, metal runs, handling marks and abnormally bad welding marks. This minimizes the amount of rough polishing needed. Thus in the final finish polishing, the positive removal of the coarser grain marks is assured.

Before beginning the polishing operation, each job is studied carefully before a decision is reached as to what direction the finishing wheel marks should take. The proper stroking of the object polished and the elimination of pulling up on the final stroke will prevent a frosty finish, an undesirable effect.

Automatic machine method of polishing is preferred, not only because the uniformity and consistency of the finish can be better maintained, but also because it is more economical. If a full automatic polish is not practical a hand polishing touch-up operation is used in conjunction with the automatic. Short runs or parts of intricate shape may be polished entirely by hand. Usually a No. 150, No. 180 emery "oil" finish and sisal brushing comprise the method of polishing the parts on the automatic machine. When parts are hand polished a No. 180 Turkish emery followed by sisal brushing is used. The last operation is a very important one. This is the brushing operation. This operation is achieved by the use of sisal brushes and a heavy duty brushing compound.

*Racking*

After the bumper guards are polished, they are racked for plating. Whenever possible, the guards are racked upside down so that any roughness, if present, will occur on the nonsignificant surface. Proper racking of parts is of extreme importance in order to get the best distribution of plate. Some shielding by means of racking is advisable to protect points from "treeing" and normally the plating on the inside is of no value if aluminum paint is sprayed on. Therefore, the distance between guards both vertically and horizontally, assumes great significance in the distribution of plate to meet specifications. Along with the proper racking of parts one should mention the relationship of the plating rack to the length of anode. Too short an anode will result in a lighter plate on the bottom piece than on the other parts. Too long an anode will produce a heavier plate or may even have a tendency to burn the bottom pieces.

*Cleaning and Plating Cycle*

The cleaning and plating cycle as practiced in this plant are as follows:

| | | |
|---|---|---|
| 1. Cathodic Clean | 9. Acid Dip | 17. Rinse |
| 2. Rinse | 10. Rinse | 18. Unrack |
| 3. Anodic Clean | 11. Nickel Strike | 19. Chrome Strip Racks |
| 4. Rinse | 12. Nickel Plate | 20. Rinse Racks |
| 5. Acid Dip | 13. Rinse | 21. Acid Dip Racks |
| 6. Rinse | 14. Rinse | 22. Rinse Racks |
| 7. Anodic Clean | 15. Chrome | 23. Rerack |
| 8. Rinse | 16. Rinse | |

*Cleaning*

The cleaning cycle begins with a cathodic treatment in a 12 oz/gal cleaner at 200° F. The guards are rinsed and a powerful spray rinse strikes the pieces as they emerge. Whenever necessary, the immersion rinse is followed by a spray rinse which is on the top of the rinse tank. The anodic cleaner is also a 12 oz/gal cleaner. The acid dip is a 25 per cent muriatic acid solution at room temperature. The sequence of two anodic cleaners with an acid dip in between has been used because parts that have been automatically

(*Continued on page 159*)

# ANALYTICAL DETERMINATION OF TRACE CONSTITUENTS IN METAL FINISHING EFFLUENTS

## VII. THE COLORIMETRIC DETERMINATION OF MANGANESE IN EFFLUENTS

EARL J. SERFASS† AND RALPH F. MURACA†

*The following paper, the seventh of a series, is a result of the work sponsored at Lehigh University by the AES and the Ohio River Valley Water Sanitation Commission. While the original procedure was worked out under AES sponsorship, the modification was developed under ORSANCO sponsorship, the commission having placed the project at Lehigh so as to be able to utilize the background developed by AES Project No. 2. It should be noted that the methods described in this series were tested, modified if necessary, and retested by at least six and sometimes as many as twelve industrial laboratories. As a result of this, the approved form, as published here, was developed.*

ABSTRACT

The colorimetric procedure for the determination of the manganese content of effluents in the range of 5 to 50 ppm that is presented, yielded satisfactory results in the presence of as much as 5000 ppm of each of twenty-four cations in simultaneous admixture, as well as in the presence of large amounts of organic materials.

The method makes use of a treatment with hot concentrated acids to remove organic materials and chlorides and a subsequent oxidation of the manganese to permanganate with potassium periodate. The intensity of the permanganate color together with interfering colorations is measured; a blank, made by bleaching the permanganate color of a similarly treated sample corrects for the interfering colorations.

### THE COLORIMETRIC DETERMINATION OF MANGANESE IN EFFLUENTS

A commonly used method for the colorimetric determination of manganese involves its oxidation to permanganate by means of persulfate or periodate. From the time of its introduction by Willard and Greathouse,[1] periodate has been widely accepted as the most suitable oxidizer. A study of the effect of a large series of cations and anions on the development of the permanganate color by periodate was carried out by Mehlig.[2] He noted no interference with development of the color although certain of these ions produced troublesome turbidities while others, such as copper, nickel and chromate, decreased the sensitivity of the method because of their color.

*Description of the Method*

Since reducing substances such as organic matter, chlorides, etc., will interfere with the formation of permanganate, their removal is effected by a preliminary fuming with nitric and sulfuric acids.[3] Insoluble substances which remain after dilution of the digestion mixture are removed by filtration or centrifugation.

Phosphoric acid is added to eliminate the color of ferric ion prior to the oxidation of manganese with periodate. After dilution to a suitable volume, the optical density of the solution is measured at 525 millimicrons. For a blank the permangante color of a sample treated similarly is destroyed by means of HCl. In this way, the blank is made to correct for the presence of other colored ions.

*Sensitivity of the Method*

The sensitivity of the method is defined as the smallest number of micrograms of manganese which can be determined with a relative error of ±50 per cent. For the following recommended procedure this corresponds to 5 ppm or 100 micrograms of manganese in the 20 ml sample taken for analysis.

*Limit of Detection of the Method*

The limit of detection of the method is defined as the minimum number of micrograms of manganese which must be present in the 20 ml portion of the sample taken for analysis so that an extinction of 0.005 for a 1 cm thickness at 525 millimicrons will be obtained in step 11. For the recommended procedure, the limit of detection is 40 micrograms of manganese (2 ppm).

The limit of detection is greatly influenced by the concentration of colored ions which may be present in the sample since they increase the value of the extinction, and the precision of the usual photometric devices are considerably less at high values of extinction. The indicated limit of detection, 2 ppm, has been experimentally verified in solutions containing 5000 ppm of each of 23 of the common cations.

Most photometers have a scale which is not sufficiently extended to permit the reading of as small a value as 0.005 in the vicinity of 0.6 extinction. Consequently, the limit of detection of manganese rises above 2 ppm whenever the inherent color of the sample yields extinction values greater than 0.600. The limit of detection can be increased by taking a larger sample provided that the amount of each ion present does not exceed a total of 100,000 micrograms.

*Discussion of Blank*

The blank is used to compensate for the color of ions like copper, nickel, cobalt, and chromium (VI), which may contribute to the absorption of light by the permanganate developed in the sample. Since both sample and blank are treated alike, it is necessary to remove the permanganate color of the blank by means of HCl additions.

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*Recommended Procedure*

This procedure is designed to be used for the determination of 5 to 50 ppm of manganese in a 20 ml sample of effluent.

*Reagents Required*

(1) Nitric acid—Concentrated, 16 N; reagent grade.
(2) Sulfuric acid—36 N; reagent grade.
(3) Hydrochloric acid—Concentrated, 12 N; reagent grade.
(4) Phosphoric acid—85 per cent syrup; reagent grade.
(5) Ammonium persulfate—reagent grade.
(6) Potassium metaperiodate—reagent grade.
(7) Standard Mn Solution—Dissolve 0.2877 gm of the reagent grade $KMnO_4$ in 100 ml of 2 per cent by volume sulfuric acid. Add a dilute solution of sodium bisulfite dropwise until the solution is decolorized. Dilute to exactly one liter, 1 ml = 100 micrograms of Mn. For establishing a calibration curve, 1 milliliter of this solution taken as a sample corresponds to 5 ppm of manganese for a 20 ml sample of effluent taken for analysis in step 1.

*Procedure*

(1) Pipette at least two 20 ml samples of the effluent into 500 ml Erlenmeyer flasks.
(2) Add 40 ml of concentrated nitric acid and 15 ml of concentrated sulfuric acid to each flask. Slowly bring to fumes of sulfur trioxide and hold at this temperature for five minutes. If the solutions are dark from organic carbon, cool, add 10 ml of concentrated nitric acid, and again bring to fumes of sulfur trioxide for 5 minutes. Repeat until organic carbon is destroyed. Do not allow the solutions to go to dryness. Add 10 ml of concentrated sulfuric acid, if necessary.
(3) Dilute the contents of each flask with about 50 ml of water. Filter the contents of each flask, if necessary, through a sintered glass funnel, saving the filtrate; wash the precipitate once or twice with water. Considerable time may be saved if the solution is centrifuged. Transfer the filtrates and washings to 500 ml Erlenmeyer flasks.
(4) Add 2 g of ammonium persulfate to each flask and slowly bring the solutions to boiling. Boil for at least 10 minutes. Note: If the sample does not contain reducing matter, omit this step.
(5) Add 15 ml of phosphoric acid to each flask and dilute, if necessary, to nearly 250 ml.
(6) Add about 0.5 g of potassium metaperiodate to each flask and slowly heat the solution.
(7) Continue heating just below boiling for 30 minutes or until the maximum permanganate color is developed.
(8) To one flask, add 4 drops (0.2 ml) of concentrated hydrochloric acid. This constitutes a blank.
(9) Heat each flask for 3 minutes under the boiling point and then cool to room temperature. Filter, if necessary, through a medium porosity sintered glass funnel. Wash the filter with water. Keep organic materials such as lint, paper, etc., away from these solutions.
(10) Transfer the solution (or filtrates and washings) to a 250 ml volumetric flask and dilute to the mark. Shake well.
(11) Measure the optical density of each solution on a colorimeter with a number 54 green filter, or on a spectrophotometer at 525 millimicrons wave length after first setting the instrument to zero with a pure water standard.
(12) If necessary, convert the scale readings of the photometer to optical density. Subtract the blank reading from the sample readings. If a calibration curve is being established, plot these corrected readings versus ppm of manganese. If a sample is being run, read the amount of manganese present from the calibration curve.

*Variations of the Recommended Procedure*

If the composition of the effluent is known, the recommended procedure can be altered to suit particular samples. In general, the procedure will be materially shortened if the concentration of all elements other than manganese are below 100 ppm each.

The following table summarizes the changes that can be made in the recommended procedure when the composition of the sample is known. Unless otherwise stated, the concentrations of other elements must not exceed 5000 ppm. For effluents containing greater quantities of these elements, dilution will be necessary. The effluent may be acidic, basic, or neutral.

TABLE I

| Composition of Effluent | Changes in the Recommended Procedure |
|---|---|
| Organic matter absent and chlorides below 15 ppm | Omit step 2. Add 15 ml conc sulfuric acid to the sample taken in step 1 and proceed with step 3. |
| Organic matter absent and all elements below 100 ppm each. Chlorides below 15 ppm | Omit steps 2 and 3. Add 15 ml conc sulfuric acid to the sample taken in step 1 and proceed with step 4. |

*A Shortened Procedure for Manganese in the Range 0.01 to 5 ppm*

The following table summarizes the changes that can be made in the recommended procedure when the effluent contains very small amounts of manganese and other elements.

TABLE II

| Composition of Effluent | Shortened Procedure |
|---|---|
| Manganese 0.01 to 0.1 ppm | Use a 500 ml sample in step 1 and continue through the scheme using one half the indicated quantities of reagents and dilution volumes. In step 10, use a 50 ml volumetric flask. In step 11 use a 5 cm cell. |
| Manganese 0.1 ppm to 1 ppm | Use a 50 ml sample in step 1 and follow the above directions. |
| Manganese 1 ppm to 5 ppm | Use a 50 ml sample in step 1. Follow the recommended procedure. In step 10, dilute to 100 ml. |


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## *RENDEZVOUS IN CLEVELAND*

# 1955 Industrial Finishing Exposition and 42nd Annual Convention of American Electroplaters' Society

The city of Cleveland will be the site of the 1955 Industrial Finishing Exposition. The show is to be held in the huge Cleveland Public Auditorium on June 20, 21, 22 and 23 in conjunction with the 42nd Annual Convention of the American Electroplaters' Society.

Widely publicized as the "best location in the nation," Cleveland is a fortunate choice for several reasons:

1. Sixty-three per cent of american industry is located within a 500-mile radius and more than half of the 8,000 plants are within an overnight trip of the city.

2. The state of Ohio has over 1,500 plants employing more than 300,000 persons in various phases of industrial finishing.

Diversification is the keynote of the industrial finishing industry in Cleveland itself. Cleveland plants finish all kinds of equipment from small jet engine parts to huge parts for secret machinery. Included in this category are: electroplating, enameling, lacquering, vitreous or ceramic finishing, electropolishing, chemical finishing and anodizing.

Of interest to the 12,000 finishing plant personnel who will visit Cleveland during the 1955 convention and show are:

1. Trips planned to various plating and finishing plants in the Cleveland area. The Plant Visitation Committee has tentatively scheduled many interesting trips. Buses will leave from Cleveland Public Auditorium for the convenience of those attending the show. Trips are being planned to both small and large job plating plants and to the large "captive" plating plants.

2. The AES Educational Sessions will be held under the same roof as the Industrial Finishing Exposition. The Program Committee has arranged for a most interesting program covering all phases of industrial finishing. The authors selected are outstanding experts in their particular fields. Details on the program will be released shortly.

3. An opportunity to exchange information will be afforded those who attend the June convention and show.

The present and future market for industrial finishing products is tremendous. With the continuing increase in U. S. population which is expected to reach 200,000,000 by 1975, coupled with increasing discretionary spending power of these people and an increasing leisure time, more people will have more time to spend more money for industrially finished products. If a period of peace is in store for us, the rest of the world will form an even larger market for American products. This all means that companies in the industrial finishing field must prepare for more business than they have ever experienced. Obsolete equipment in obsolescent plants with out-dated information is not going to help companies get their full share of these markets.

The convention affords terrific opportunities for the exchange of information so essential to the continued progress of the industry as a whole. The outlook for the plating industry is staggering. With the expected rise in population, and its accompanying increased buying power, it will take a forward-looking industry to supply the market.

The companies that do not keep up with the times cannot expect to maintain their share of new business. Organizations which are characterized by obsolete equipment, poorly planned plants and out-of-date information will find themselves in a precarious position.

The degree of importance given to the coming meeting by manufacturers of equipment is obvious from a recent report by Harold Bartlett of the American Decorating Company, exposition managers of the 1955 show. The report states that more space has already been contracted than for any previous show held by the American Electroplaters' Society.

It is your show, your convention and your opportunity to gain the know-how and ideas your company will need to make the profits that are there and will be there in the next few years.

Cleveland Public Auditorium

# THE PLATING OF POWDER-METALLURGY BRONZE PARTS

E. V. RAYMOND, R. T. FOLEY AND W. L. CHU*

## Introduction

During the last decade the industrial usage of parts made by powder metallurgy techniques has increased enormously. Many manufacturers have seen the advantages to be gained by using parts so fabricated that they require little or no machining. However, the widespread introduction of powder metallurgy parts to industry has presented the electroplater with many difficult problems.

By the very nature of the material, parts made by powder metallurgy techniques are more difficult to plate than the same parts made by more conventional methods of fabrication.[5] This is readily appreciated by viewing Fig. 1, a cross-section of a bronze powder metallurgy part at 200X magnification, and considering what the response of this type of structure would be to various electroplating treatments. The system of interconnected pores and the greatly extended surface area create the difficulties.

The surface of the powder metallurgy part is composed of sharp hills and deep valleys, exaggerated even when compared to a deeply etched surface. When this surface is plated, the plate usually lacks continuity. Moreover, the thickness of the plate, as estimated by current density calculations, is low in comparison to the measured thickness. This is because the true surface area is many times the apparent area (as obtained by linear measurements).

The porosity of the piece introduces further difficulty. The conductivity is lower than expected. Also the electrolytes from the cleaning or plating solutions are drawn into the connecting channels by capillary action. These salt solutions are not removed by ordinary rinsing which means that interior corrosion will result in time. Later, the trapped electrolyte may diffuse out through pores or absorb moisture from the air. This yields the familiar "spotting out" effect which is usually a forerunner to serious corrosion. Any proposed plating method, to be effective, must take into account the nature of the powder metallurgy part and the problems of porosity and enhanced surface area presented by the structure.

## Literature Background

Some of the problems involved and certain recommended solutions have been discussed in the plating literature.

In several cases the need for extensive rinsing and careful neutralization of residual acid has been emphasized. Scott[1] has described certain rinsing and neutralization steps that lead to the successful finishing of brass parts. However, generally it is admitted that rinsing alone is not adequate to achieve a good electroplate.

It seems reasonable that if the surface pores of the powder metallurgy part are closed, the absorption and later "spotting out" could be eliminated. An extensive investigation[2,3] covered the best mechanical preparation to close the pores of 85–15 brass parts for further plating. Buffing prior to plating, as well as certain other mechanical treatments, was apparently successful.

The impregnation with a molten metal, such as lead, has been suggested; here again to close the pores. Along a similar line an impregnation scheme, utilizing a silicone resin is reported.[4] The silicone would set within the pores and make the object water repellent below the surface.

Kuzmick[5] reports a method of removing the corrosive electrolyte by volatilization at elevated temperature. The plating salts left in the part are converted to easily volatilized salts before sintering. For example, iron parts were sintered or resintered at about 2000° F after being nickel plated. The salts were destroyed or volatilized and the nickel plate diffused a short distance into the surface.

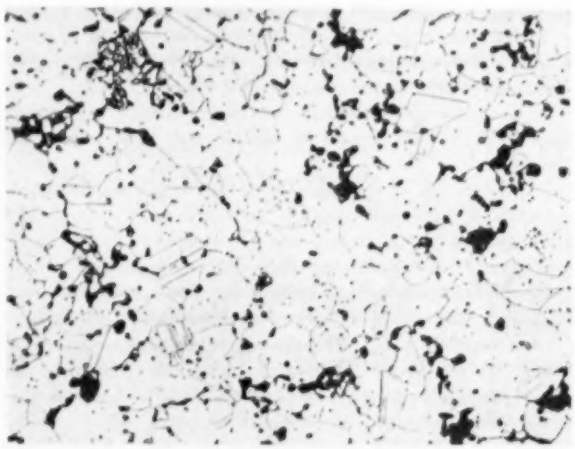

*Fig. 1. Cross-section of powder metallurgy bronze part. Density about 90 per cent—magnification 200X*

## Experimental

The object of the present investigation was to examine those methods which had been reported in the literature with the view of tin plating a sintered bronze part. It was required that the tin plate on the bronze part give maximum protection as defined by the expected life of a tin plate of the same specified thickness over a solid wrought bronze piece.

The bronze part to be plated had a density of 7.4 as compared with 8.2 for a wrought bronze of the same composition. Thus, the part was approximately 90 per cent dense. The chemical composition of the alloy was:

| | Per Cent |
|---|---|
| Cu | 95.0 |
| Sn | 4.8 |
| Pb | 0.09 |
| Zn | 0.07 |
| Fe | less than 0.01 |

The cross-section of the part is revealed by the photomicrograph in Fig. 1.

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### Preliminary Experiments

Several of the methods described above were used in an attempt to achieve good tin plates on these bronze parts. As the details of these methods have been reported by other authors, no attempt will be made to describe the procedures in detail. However, the main objections to these methods, which necessitated further research will be pointed out.

Cold working of the surface by repressing the sintered part at 100,000 psi was successful in closing the pores and resulted in a nonspotting tin plate. However, this method was judged too expensive, as it would require the manufacturer to employ additional expensive dies.

Plating tin by immersion was attempted. The object was to obtain a thin coating which would block the smaller pores, coat the deep recesses, and provide a continuous base for further plating. This technique yielded a plate that "spotted out" in 24 hours.

Impregnation with silicone oil by a recommended procedure did not appear to be a dependable method. When the plated parts were cross-sectioned and exposed to laboratory air, staining was observed after several weeks.

The same was true when an attempt was made to utilize a method that involved volatilization of residual salts. The parts were copper plated, heat treated, and tin plated. However, parts so plated stained after being cross-sectioned and exposed to laboratory air for several hours. A bluish-white corrosion product collected after several weeks' exposure.

The failure of these well-known methods to give a process that was at once reliable and inexpensive, led to the investigation of an oil impregnation process.

### The Oil Impregnation Method†

It seems logical that if the diffusion of electrolytes into the pores of the sintered alloy during cleaning and electroplating could be hindered, "spotting out" after plating would be eliminated. It is for this reason that experiments were performed in which sintered parts were impregnated with oil and then electroplated.

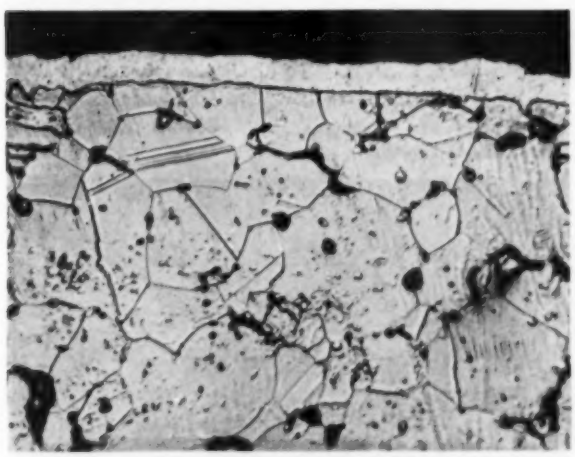

**Fig. 2. Cross-section of powder metallurgy bronze part which had been tin plated by the oil impregnation method. Magnification 500X**

Oxides and other objectionable surface films were first removed by grit blasting with a fine abrasive. The parts were then immersed in a lubricating oil at 100° C and allowed to remain in oil until the oil cooled to room temperature. The time of immersion did not appear critical and it seems that the oil could as well be cooled artificially. After arrival at room temperature, the parts were removed and allowed to drain. The external oil was removed by agitation in a mild soap solution at 50° C. The parts then were rinsed in cold water and plated. The plating was carried out in the conventional sodium stannate bath at a current density of 0.4 amp/piece. This would be equivalent to a current density of about 40 amp/ft² on the basis of the apparent area. It should be emphasized, however, that the current on an area basis is not significant, as the measured surface area is quite different from the real area. A voltage was applied between anode and cathode before the parts were suspended in the plating bath. This insured immediate coverage with tin. The plating was allowed to continue until a thickness of 0.0010 inch to 0.0015 inch was achieved.

No "spotting out" was observed on samples plated by this method, nor did sectioned samples stain when their cut surfaces were exposed to the laboratory air for several months. On several samples, up to 0.003 inch of tin was deposited. These specimens were heated up to the melting point of tin without blistering, indicating a plate of good adherence. At the raised temperature, oil was driven out from the interior of the sample through pores in the tin plate. It appears that the oil within the sample serves as a reservoir which will supply oil to the pores when the sample is heated.

It was concluded that tin plated parts processed by this oil impregnation method would be less expensive and more resistant to corrosion than those prepared by above methods.

A photomicrograph of an oil impregnated and tin plated sintered bronze piece is shown in Fig. 2. The lack of voids between base metal and plate is obvious.

### Properties of Powder Metallurgy Bronze Parts Plated by Oil Impregnation Method

As was mentioned above, a good test for entrapped electrolyte was to cross-section a sample and expose to the laboratory air. Samples with considerable entrapped salt solution stained overnight or developed the corrosion products usually associated with chemical attack on copper. Powder metallurgy parts oil impregnated and tin plated did not show this corrosion after several months so tested. Other more accelerated tests were run in cabinets containing a salt fog, a high-humidity atmosphere and an atmosphere of high-sulfur gas concentration. For comparison, samples of the same dimensions were machined from a solid bar of an alloy of the same composition and tin plated. In all cases, the corrosion rate of the plated powder metallurgy part proceeded in a manner similar to that of the plated wrought piece.

It is postulated that on longer term tests the oil impregnated and plated samples will actually show improved corrosion resistance. On heating and cooling, the oil within the sample should slowly diffuse outward and spread as a thin film over the surface. That the tin plate has a definite porosity is well known and has been demonstrated in the heating experiment described above.

†U. S. Patent Pending.


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Joint session of the two classes in electroplating. This merger takes place when a guest lecturer addresses the group

# A CLASS GROWS IN BROOKLYN

## *Electroplating Course Enrollment High at Brooklyn Evening Tech.*

By LOUIS SEROTA

The course in electroplating conducted at the Brooklyn Evening Technical High School was organized in September, 1950. The need for the development and improvement of technical skills for the men employed, so essential in modern plating operations, was a basic reason for the introduction of this plating course. The concentration of plating shops in the metropolitan area seemed to provide a fertile field for such a program. The sustained interest, as evidenced by the registration each term, is ample proof that an educational program is eagerly sought by many associated with the industry. Members of the class represent all branches of the plating field from the tank operator to foreman, supervisor, salesman and the small shop owner. To some the course serves as an introduction to the principles of chemistry and electricity in its relation to the electrochemical processes. Others find it helpful as a refresher course or as a means to a better comprehension of technical terms relating to the various phases of electroplating. The laboratory facilities provide adequate opportunities for laboratory exercises which serve as a supplement to classroom discussions. Lab work is effective in acquainting the students with the methods of control and development of the skills required for the application and use of such equipment. Hull Cell studies, *p*H meter, hardness by Rockwell or Schore Scleroscope, analytical procedures are some of the equipment used and operations performed.

Objectively, the course was planned to include a study of the fundamentals of chemistry and electricity; association with men prominent in the field by their appearance as guest lecturers or through attendance at meetings of the New York branch of the American Electroplaters' Society; an understanding and appreciation of the practices of electroplating; evaluation of literature as a reference medium and as a source of information relating to new developments. The course, integrated in such manner could provide, in its broad outline, the opportunity for free education offered by the Evening School Division of the Board of Education of the City of New York.

The attentiveness of the members of the class during a guest lecture and the extended question-answer period is a signal indication of their search for knowledge. It is indeed convincing evidence of the value and importance of adult education. Such men as Walter H. Prine of International Nickel Company, Walter A. Raymond former editor of Metal Finishing, Martin Mayer of Oakite Products, George Schore secretary-treasurer of the New York Branch of the AES, Peter Viet librarian of the AES, E. C. Rinker of Sel-Rex Precious Metals, and Nathaniel Hall editor of Metal Finishing served enthusiastically and were profoundly impressed with the eagerness of these men to grow with the industry.

Membership in the AES is sought by an appreciable number each term. The advantages of membership as an educational service is indicated by frequent reference in class to topics that are scheduled for current meetings. Many, who had always procrastinated, readily accepted applications while others, on learning about the Society for the first time, seek membership.

Samples of electroplated metal are tested in the material testing laboratory. Hardness tests are made on the Brinnell (rear) scleroscope (center) and Rockwell (B and C scale) front

Studies of abrasives and compounds for polishing and buffing are carried out in the lab

Current efficiency determination of a nickel bath solution with a copper coulometer in series

References to articles appearing in PLATING and other publications relating to electroplating are made constantly. Emphasis is placed upon the value of such journals as a reference library. The response to this phase of the course is in itself a fulfillment of one of the objectives.

An indication of the awareness of the need for educational programs was highlighted during the current term. A supervisor of a large barrel plating and tumbling processes shop enrolled with three of his key men. Whereas the course will serve him as refresher this supervisor wanted his men to become familiar with the fundamentals of science relating to plating. In that manner they will be better prepared to perform the necessary control tests and qualify for the responsibility they must accept for the efficient operation of their departments. As this supervisor expressed it "if they are capable of doing their job, I can devote more time to supervision."

Another example of the benefits of education is the case of the shop foreman who in addition to learning how to control his tanks by analytical checks, introduced chelating agents in his nickel tanks with quite satisfactory results. Control was based upon Hull Cell studies which he introduced. The same member of the class who was asked by the shop owner what he knew about electroless nickel is now studying the process in the laboratory.

A supervisor of a large plating shop persuaded the owner

Hull cell panel tests. Samples of plating tank solutions are studied. Test panels provide an effective tool for tank control

of the plant to invest several thousand dollars in laboratory equipment and control units. Reluctance to make such investments showed a continuing decline as the advantages in better control and improvement in production quality became evident. This member attends the Society's meetings regularly and has continued his studies for several years. His progress reflects the confidence gained as a result of such extensive and intensive studies and associations. Many requests about enrollment for their men are made by owners and supervisors.

The few instances cited emphasize the need for a nationwide educational program if a source of technically trained men essential for the operation of modern electroplating processes is to be maintained.

Serota addressing the class

### LOUIS SEROTA

LOUIS SEROTA organized a free course in Electroplating in 1950 at the Brooklyn Evening Technical High School. Member of the New York Branch of the A.E.S. Instructor in Industrial Chemistry at the Brooklyn Technical High School for twenty-five years. Received B.S. degree from the Brooklyn Technical Institute.

## AES RESEARCH PROJECT NO. 14

# THE INFLUENCE OF THE PHYSICAL METALLURGY AND MECHANICAL PROCESSING OF THE BASIC METAL ON ELECTROPLATING

## PART I
## CRITICAL REVIEW OF THE LITERATURE

**A. E. R. Westman*** **and F. A. Mohrnheim***


### SUMMARY

*A critical review is presented of the literature up to June 1953 which relates to the influence of the properties of the basis metal steel on the quality of electrodeposited nickel or nickel-chromium. The operations are described which may be performed on the steel from the early stages of manufacture to the polishing and buffing operations immediately prior to electrodeposition. There are many apparent contradictions in the literature as to what influence, if any, may be exerted by the resulting physical properties of the basis metal steel surface, particularly with respect to the influence of the polishing operation. Some of these may be resolved if the nature of the manufacturing operations performed on the steel are taken into account. There is abundant evidence that the polishing operation results in a flowed layer which has physical properties quite different from that of the underlying metal. This layer is microcrystalline and not amorphous, as frequently stated in the earlier literature. What influence this layer may have on electrodeposition and how completely it should be removed in cleaning operations is an unsettled question.*

*There is a substantial body of opinion which favors the elimination of the polishing operation wherever feasible. This eliminates the flowed layer as well as slivers, sharp contours, etc., which are considered undesirable.*

*That slivers of basis metal projecting some distance into the electro deposit may weaken corrosion resistance can readily be accepted. However, the effect of other surface irregularities whose rms value may be only one-thousandth that of the thickness of the deposit provides a more difficult problem. Some mechanism whereby irregularities in the microgeometry of the basis metal result in points or planes of galvanic weakness to the deposit is required. Similarly, the effect of stresses and strains in the basis metal is not easy to visualize or to demonstrate experimentally. No sure guide is afforded by the literature. In a fundamental study of many factors affecting porosity of electrodeposits, Evans and Shome were able to demonstrate a definite effect only with respect to microgeometry.*

*The main conclusion from this study of the literature is that there is need for a more metallurgical approach to the problem and for more closely controlled and prolonged experimentation in this field starting possibly with an investigation of the effect of the microgeometry of the basis metal.*


### Statement by Project Committee

A basis metal object is electroplated in order to provide a surface with properties superior to those of the basis metal. In most cases, adherence, appearance and resistance to corrosion are the important properties required. Ideally, these properties should be retained for the useful life of the object but for many products the thickness of electroplate required to do this with present-day techniques is too costly or introduces other technical problems. The ultimate object of most electroplating research is to enable the electroplater to approach the above ideal as closely as possible and at reasonable cost.

When an electrodeposited coating fails to adhere to the basis metal, to provide and maintain a satisfactory appearance or to protect the basis metal for the useful life of the product, it is natural to ask to what extent this failure was due to factors which determined the properties of the basis metal and its surface prior to the cleaning and electroplating operations, and which are commonly not under the control of the electroplater. In other cases, such failure may have been avoided only by the electroplater going to extra trouble and expense in the cleaning and electroplating operations in order to overcome the deficiency of the basis metal.

### Scope

To avoid dissipation of effort, it was considered advisable to limit the investigation at first to the study of steel as a basis metal for the deposition of nickel and nickel-chrome coatings.

### Object

The initial purpose of the project is to study the properties of steel used as a basis metal in electroplating prior to the cleaning operation and to determine to what extent these properties may influence the properties of the cleaned and plated product.

If, in the light of the information obtained, it appears desirable to exercise more control over the properties of the steel prior to cleaning, then the setting up of standards will be considered. Standard for both the "as received" and "prior to cleaning" stages may be required.

Standards for the cleaning process are in the process of development by Project No. 12.

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## 1. Introduction

The manufacture of a nickel-plated steel article may be divided into the following stages:

(a) steel manufacture—to strip, sheet, rod, etc.
(b) forming—punching, drawing, etc.
(c) grinding
(d) polishing
(e) buffing
(f) cleaning
(g) plating

In each stage certain actions are taken and certain process variables come into play. These may or may not influence the properties of the final product depending upon the extent to which their effect is counteracted in subsequent operations. The electroplater receives the steel article from the fabricator, he grinds and polishes it, thereby removing some of the surface and therefore some of the effects of the earlier stages in the manufacture. However, he may also introduce other effects at the same time. In the cleaning operation further material is removed from the surface and even in the plating operation some change in the surface may occur.

This project is concerned with those effects introduced in stages (a) to (e) inclusive. These effects may be such that they are removed in the normal course of the later operations or such that they are not removed but still have no effect on the final properties of the plated article. On the other hand, it may be found that some of these effects may have a decided influence on the properties of the plated article and can be counteracted, if at all, only by rather drastic intermediate stages which are uneconomic.

In order to show what variations may be introduced in the production of a steel article for electroplating, the stages (a) to (d) will now be discussed in turn. Since most steel articles are made from strip steel, it will be taken as an example.

## 2. Manufacture of Steel Strip

### (a) *Literature*

The following is a brief discussion of the stages in the manufacture of steel strip. For details the reader is referred to the book entitled "The Making, Shaping and Treating of Steel," a revision of the original by J. M. Camp and C. B. Francis, 6th Edition (1952).

### (b) *Steel Making*

In America steel is made in a basic open hearth furnace, a Bessemer converter or a basic electric furnace. Since over eighty per cent is usually made in a basic open hearth furnace, it will be used as an example here.

The purpose of the steel-makng process is to take pig iron (the product of the blast furnace) and steel scrap and produce a more refined material of lower and specified carbon content in the form of steel ingots suitable for rolling.

The molten steel of the required refinement and analysis is poured from the furnace into a ladle from which it is poured into a series of molds of the desired dimensions where the metal is allowed to solidify. The solidified steel castings are called ingots.

The properties of an ingot and of the steel rolled from it are influenced very strongly by the amount of gas evolution which occurs while the steel is solidifying in the ingot mold. A steel which produces only a small amount of gas is said to be "killed" and the various types of ingot are known as killed, semi-killed, capped and rimmed as the amount of gas evolution increases. The gas is produced by a reaction between iron oxide (FeO) and carbon (C) dissolved in the steel to form carbon monoxide (CO). The solubility of the gas in the steel steadily decreases as the steel cools and solidifies.

Since there is always sufficient carbon present for a violent evolution of gas, the amount of gas evolved depends on the amount of iron oxide (FeO) available for the reaction. This depends on the carbon content of the steel when poured, the oxide content being greater as the carbon is less, and upon the amount of deoxidizers added in the furnace, ladle or ingot mold. Such deoxidizers include aluminum, ferro-silicon, etc., which react readily with iron oxide to produce iron and oxides of aluminum or silicon and thus prevent carbon monoxide formation.

With high-carbon steels, the amount of iron oxide dissolved in the steel when poured is too low to permit the production of rimmed or capped ingots but semi-killed or killed steel can be made by deoxidizer variation. In very low carbon steels any type can be produced by an adjustment of the amount of deoxidizer used. Thus, there are practical advantages in making the lower carbon grades rimmed or capped, and the higher carbon grades semi-killed or killed.

The amount of gas evolution determines, in large degree, the internal structure of the ingot produced. To take the extreme cases as illustrations, a killed steel ingot will have a relatively uniform composition but due to its high shrinkage will have a large deep depression or "pipe" at the top. In contrast, a rimmed steel ingot will have an outer layer or rim of relatively low carbon content extending about half way to the center, and will not have a pipe, since enough gas is produced to form a honey-comb structure at the botton and sides of the mold thus counteracting the shrinkage of the metal. This variation in ingot structure from "killed" to "rimmed" steel is illustrated in Fig. 1.

When a killed steel is solidifying in an ingot mold, there is little, if any, gas evolution and freezing occurs progressively from the outside to the center by the growth of dendrites, i.e., tree-like crystals of ferrite or pure iron. The remainder of the steel is trapped between the branches of the dendrites. Thus, certain elements such as carbon show little change in concentration from the outside to the inside of the ingot; other elements tend to concentrate in the last steel to freeze, i.e., along the axis of the ingot and near the pipe at the top center.

When a rimming steel is solidifying in an ingot mold, there is the same tendency for ferrite or pure iron to crystallize first as dendrites. However, the molten steel between the dendrites is thus concentrated in iron oxide and carbon and a violent gas evolution ensues which prevents the trapping of impure iron and favors the further deposition of pure iron. Thus a sharp boundary between a rim of solid ferrite or pure iron and the still liquid steel is set up, the latter being stirred strongly by gas evolution which also tends to carry inclusions to the top of the ingot. This rimming action usually stops when the rim has advanced about one-half way to the center of the ingot, the remaining steel then solidifying without much stirring to form a core which differs sharply from the rim, particularly in carbon, sulfur, phosphorus and prevalence of inclusions. This difference is readily seen on metallographic examination, the core and rim having the appearance of quite different steels.

During the rolling process, this difference between the rim and core in a rimmed steel persists. Even the thinnest sheets will be shown to have a definite rimmed zone of relatively pure iron on metallographic examination. Rimming steel is preferred in rolling strip and is advantageous for cold forming. Since the electroplater is usually plating on objects formed from strip, he will usually be depositing nickel on this relatively pure rimmed zone.

With high-carbon steels, however, killed or semi-killed steel is more likely and the above condition will not hold.

Since laboratory investigations of electrodeposition on steel have been made for the most part on thin steel panels cut from strip or sheet, it is likely that in most cases the plating has been done on a rimmed zone of relatively pure iron. Consequently, the conclusions reached may not be applicable to other kinds of steel.

Where thin rimming steel is used in practice there is the possibility that severe grinding and polishing at corners and bends may remove the rimmed zone entirely and expose the less pure and less homogeneous core.

All steel ingots contain more or less non-metallic matter, consisting almost ex-

clusively of oxides which are derived chiefly from the oxidizing reactions of the refining process or the deoxidizing materials added in the furnace ladle or molds. These may appear on metallographic examination as oxides, sulfides, silicates, etc. For the most part, they are concentrated in the inner zone of the steel and consequently do not interfere with electrodeposition. Admixed furnace slag is only a minor source of inclusions.

(c) *Rolling to Strip or Sheet*

Although strip steel is commonly referred to as "hot rolled" and "cold rolled", all steel ingots pass through a succession of stages of hot rolling which may or may not be followed by one or more stages of cold rolling.

The solidification of a steel ingot is essentially a process of crystallization, the final steel being composed of tiny individual crystals or "grains". Within any one grain, the atoms are arranged in a definite pattern or lattice, that is, in regular rows and layers having parallel directions. From grain to grain, the direction in which these rows run will vary in a completely random manner unless some influence has tended to make them assume a more or less parallel direction or preferred orientation.

When steel is hot rolled, the grains are deformed and elongated in the direction of rolling but the steel is hot enough (593° C–740° C) (1100° F–1300° F) so that recrystallization occurs very rapidly. New grains are initiated at a number of points in the steel and grow with a random orientation until they meet each other to form grain boundaries. In spite of recrystallization, some elongation persists even in hot rolled steel in the form of "fiber" and "banding". Fiber is due to the elongation of inclusions and regions of inclusions. Banding owes its origin to the differences in composition set up when the ingot solidifies. The bands are narrow elongated regions running parallel to the direction of rolling. There are slight differences in chemical composition from the edge to the center of each band. Normally, fiber, and banding can only affect plating on sections through the steel strip.

In cold rolling which, in modern cold-reduction mills, is done at room temperature, no spontaneous recrystallization occurs and the grains are left in elongated and oriented form unless they are annealed.

In hot-rolled strip the surface is bound to be far from smooth because of the hot-rolling scale which must be removed by pickling or other means. Cold rolling, on the other hand, may impart a very smooth surface, the smooth cold-rolling mills ironing out surface imperfections. A particularly smooth finish may be imparted by pickling a cold-rolled sheet followed by a light pass through the rolls again.

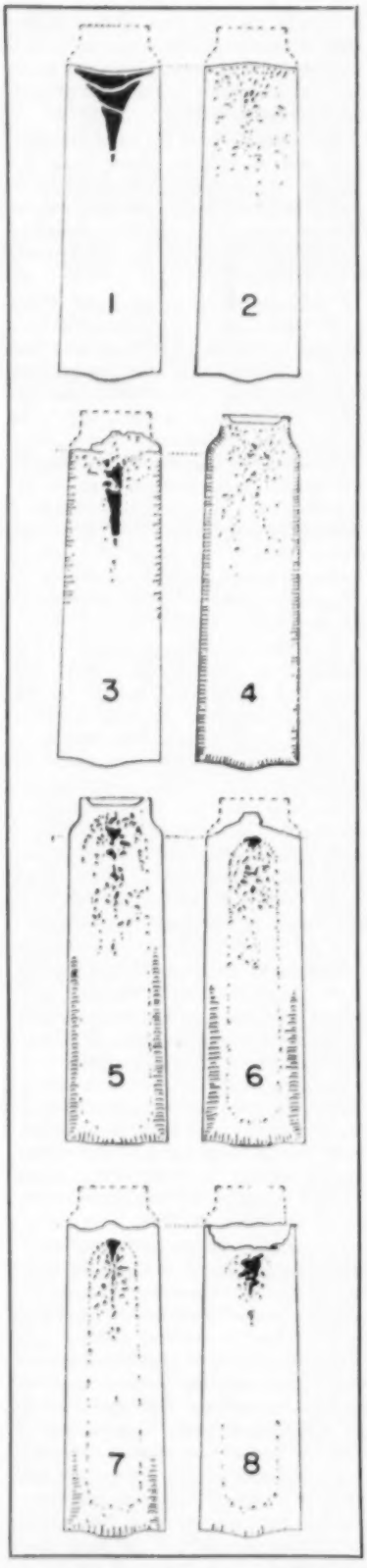


**Fig. 1. Diagrammatic sections of typical steel ingots, 1—killed; 2 and 3—semi-killed; 4 and 5—capped; 6, 7 and 8—rimmed. (From "The Making, Shaping and Treating of Steel", 6th ed., U. S. Steel Company, Pittsburgh)**

The surface of the rolls used in cold rolling progressively deteriorate and the rolls must be reconditioned at regular intervals. When rolling sheet steel to meet an exacting specification for surface smoothness on one face, it is rolled so that that face will be contacted by the roll which has been reconditioned most recently. For this reason, close examination of a cold-rolled strip will usually reveal a difference in smoothness between the two surfaces.

If a finished strip of rimmed steel which has not been slit is sectioned at right angles to the direction of rolling, etched and examined, it will be seen that the rimmed zone now consists of a thin layer forming the top surface and another thin layer forming the bottom surface of the strip, both of which are continuous with a rather wide marginal band on either side of the strip. (Thus, when strip steel of "skelp" is formed into tubing by the continuous weld process, the welding is done between the two edges of the strip which are relatively pure iron.)

(d) *Annealing*

In the case of hot-rolled strip made in a continuous hot-strip mill, definite finishing, piling and coiling temperatures are used which enable the steel to be produced in the "as rolled" condition to satisfy most requirements.

When steel is cold rolled or cold worked in any way, its mechanical properties are changed. Ductility is decreased and tensile strength increased. This hardening may be removed by annealing, i.e., by heating above the recrystallization temperature, the end result being a smaller grain size than that obtained with hot-rolled steel, unless the cold-rolled steel is annealed at too high a temperature.

If no annealing is done, the strip or sheet is sold as "full hard". Intermediate tempers are obtained by predetermined percentages of cold reduction from the hot-rolled condition.

Where annealing is required, it is carried out by either a batch process or a "box annealing", or by a continuous process. Box annealing is applied to about 90 per cent of steel products. It involves heating at or just below the "lower critical temperature" for several hours and provides the softest possible product. The critical temperatures are temperatures at which phase transformations occur in the crystals, i.e., the atoms rearrange themselves to form a different type of lattice. By annealing below the lower critical temperature no phase transformations occur although recrystallization can proceed, i.e., the atoms rearrange themselves to form new lattices of the same type as the old, merely differing in orientation.

Thus the grains elongated by cold reduction and having greatly distorted lattices are replaced by equi-axed grains with undistorted lattices and the steel will be soft and ductile.

During recrystallization, grain formation starts at a number of centers, the number being larger the greater the cold reduction. The growth of a grain is usually stopped by the advancing fronts of neighboring grains. However, as the temperature is increased, there is a greater tendency for two growing grains to assume the same lattice alignment and merge to form a single grain. Thus, the maximum annealing temperature determines the finished grain size for a given grade of steel, hot and cold-rolling practice. Heating for long periods below the critical temperature has little effect on grain size with common steels but does increase the softness and ductility.

"Normalizing" is used where box annealing is inadequate, for example with certain alloy sheets and with "pure iron" (less than 0.10 per cent impurities), such as is used in vitreous enamelling, which recrystallize sluggishly in box annealing. In normalizing, the steel is heated above its upper critical temperature, around 1800°F for low-carbon steel, and is cooled at such a rate that the grains formed by a phase transformation will be of the desired size.

Continuous annealing is applied to tin plate stock which requires a higher hardness than sheets. Tin plate stock cold-reduced to a thin gauge travels at high speed through a furnace in which a non-oxidizing atmosphere is maintained. By heating above the lower critical temperature for a very short time, recrystallization is almost instantaneous.

(e) *Analysis*

About 80 per cent of the steel strip and tin plate stock made in the United States has compositions within the range

| C | Mn |
|---|---|
| 0.03 – 0.12% | 0.20 – 0.60% |

| P | Other Elements |
|---|---|
| 0.02% max. | as low as possible |

A special grade of rimmed steel which approaches closer to pure iron in composition (C – 0.03%, Mn – 0.04%, P – 0.010%, S – 0.030%) is used in vitreous enamelling for products where its superior enamelling properties justify its higher cost. Its electroplating qualities do not appear to have been investigated.

The silicon content of a rimmed or capped steel is usually under 0.02 per cent but silicon is present up to 0.15 per cent in killed steels when silicon is used as a deoxidizing agent.

(f) *Summary*

It is evident that steels may differ greatly not only in composition but also in microstructure, distribution of impurities, nature and prevalence of surface defects and in many physical properties which are determined by pouring, rolling, pickling, and annealing practice. Discussion in the literature[104,108,27,126,140,151,121] has been concerned largely with the presence of mill scale and other defects in the surface. Hogaboom[27] states that oxide rolled into the steel in the hot-rolling process is often not fully removed in the pickling prior to cold rolling but is covered over in the cold-rolling process. Polishing with a coarse wheel may break through to this oxide which will cause trouble in plating. He suggests that this is the reason why it has been found better in practice to avoid polishing, particularly with coarse abrasives. This will be discussed later under polishing. Dennison[161] describes how various surface defects may arise in the steel-making process. Hammond, in the discussion of reference 161 cites a case in which chalk marks made on steel sheet during manufacture were reproduced in a hot water test of nickel plate on the steel although they were invisible on the cold rolled sheet. Dennison[161] considers that continuous strip is preferable to pack rolled sheet.

The defects described in the literature are largely of two kinds: (a) nonmetallic inclusions and (b) pores. Nonmetallic inclusions, including oxide scale which may be rolled into the product are considered to have little if any electrical conductivity and poor wettability. Consequently, they are not covered readily by electrodeposition. Both pores and other defects below the surface of the steel are considered to lead to blistering due to hydrogen in the pickling process diffusing through the steel as atomic hydrogen, and building up high hydrogen pressures at defects and pores. It has been demonstrated that some cold-rolled steel will blister in 5 per cent hydrochloric acid. Jevons[126] considers that sub-surface pores may fill with plating solution causing subsequent peeling and blistering.

These and similar discussions indicate that the practical as well as the experimental electroplater should be on the lookout for defects in steel which may adversely influence the quality of an electroplated product on the one hand or may confuse experiments or even lead to wrong conclusions on the other. Fulforth[102] suggests specifications to be followed in the purchase of cold-rolled strip.

Not much has been published on the effect of microstructure on electroplating qualities. Boyer[104] considers that a pearlite structure, i.e., a structure consisting of alternate bands of ferrite (pure iron) and cementite (iron carbide) is ideal for electroplating and superior to ferrite alone on the grounds that the chemically heterogeneous surface is more active. His hypothesis that alloying occurs between the electrodeposited metal and the steel basis metal is not in agreement with other work in this field. Most experimental work on the electroplating of steel has been done with cold-rolled sheet which is usually made from a rimming steel of low-carbon content. The surface of such a sheet will be almost pure ferrite and it is mainly the electroplating properties of ferrite which have been investigated.

It is the common practice in industry for the steel maker to furnish a steel which will meet the fabrication requirements of the customer. The steel maker frequently does not know or may be little concerned with the fact that it will ultimately be electroplated.

By way of contrast, a considerable amount of research has been undertaken by the steel companies in an effort to produce special steels for the vitreous enamelling industry. The high purity ingot iron mentioned above has been in use in this industry for many years and a titanium bearing steel in which all the carbon is combined with titanium has been developed recently to simplify the production of one-coat white enamels.[198] It is true, however, that much of this research has been concerned with meeting the problems which arise when the steel is heated to enamelling temperatures.

### 3. Stamping and Forming

(a) *General*

Practically all electrodeposition of nickel and nickel-chrome is done on partly or wholly fabricated products. Thus, the fabricator comes between the steel maker and the electroplater. There are thus opportunities for the accidental marking, deformation and rusting of the surface of the basis metal. In addition, there are effects of a less accidental nature introduced by such operations as stamping and forming. These include burrs, die marks, scoring and scratching as well as stresses, strains, microscopic tears and disturbed microstructures which necessarily accompany these operations. Inability of the surface of the basis metal to adjust itself uniformly to such operations as drawing may show up as an "orange-peel" appearance, usually associated with a coarse microstructure, or as stretcher strains, usually associated with an aging process which will be discussed later.

(b) *Avoidance of Defects*

Several authors[126,181,108,27] have dealt with the various defects which may be found in steel strip and sheet or may be introduced during forming operations. Ways of specifying suitable steel and of protecting it during handling and forming operations have been suggested. In many cases, the advantage to be gained is largely that of avoiding any polishing, particularly with the coarser grade of abrasive. Such polishing is often required only in order to remove surface defects acquired in handling and forming. The possible disadvantages of polishing will

be discussed in the next section. There is enough belief in its disadvantages currently, that the trend in industry is toward more care with the earlier handling and fabrication, so as to eliminate the polishing operation. Buffing prior to cleaning and electroplating, however, is still considered desirable since it smooths out surface contours.

(c) *Stress and Deformation*

With regard to the more obscure effects of a forming operation, such as the deformation of the microstructure and the incorporation of residual stresses, few studies appear to have been made. In investigating the concentration of pores in nickel plate above scratches on the basis metal surface, Evans and Shome[92] concluded that the stresses in the surface caused by scratching were unimportant, since the effect was not removed by careful annealing, and that only the geometry of the surface was important. Stresses in electrodeposits have been studied much more than stresses in the basis metal, the latter mainly in connection with surface stresses introduced in polishing. It is often taken for granted in the literature, that a strongly deformed basis metal is not suitable for electroplating. Most of the cases where some experimental basis exists for this opinion relate to high-carbon steel and to rather thick brittle deposits such as chromium deposits. Very high stresses can be built up in such steels. If these are just below the stress required to produce cracking, the changes in temperature, contact with hydrogen, etc., which occur in electroplating may add enough to the stress to crack the basis metal and therefore the deposit.

(d) *Stretcher Strains*

If a fully annealed steel sheet is subjected to increasing tension, it does not pass smoothly from the elastic to the yielding condition but part of the extension occurs suddenly at the yield point. If such steel is subjected to a shallow drawing operation where part of the steel is extended just to the neighborhood of the yield point, an irregular pattern of extension is encountered known as stretcher straining. To avoid this, steel strip and sheet is given a final cold pass in the rolling operation which work hardens the surface sufficiently to avoid the above defect. If the sheet or strip is stored for a long period even at room temperature, an aging process occurs in which the work hardening is relieved and the steel will again show stretcher strains. This defect seems to be readily recognized after the forming operation and possibly no product showing stretcher strains is submitted to the electroplater. However, it is conceivable that a mild occurrence of this defect might pass the usual inspection and still show up in electroplating.

## SUMMARY OF LITERATURE

This literature survey summarizes previous work on the influence of the physical metallurgy and mechanical processing of the basis metal on electroplating. To avoid dissipation of effort this investigation is limited to the study of steel as a basis metal for the deposition of nickel and nickel-chromium coatings.

A study is devoted to the properties of steel used as a basis metal in electroplating prior to the cleaning operation and to determine to what extent these properties may influence the mechanisms of the cleaning and plating. The study of the literature indicates that there is need for a more metallurgical approach to the problem and for more closely controlled and prolonged experimentation in this field, starting possibly with an investigation of the effects of the microgeometry of the basis metal. A comprehensive bibliography on the influence of the basis metal in electroplating is also presented.

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# Bumper Guards

(*Continued from page 146*)

polished using grease or oil, are usually much more difficult to clean than a part hand polished. Greater pressures are used on the automatic machine and so consequently more heat is generated on the surface which makes the surface film more difficult to remove. The sequence described proved to be more effective in removing this difficult smutty film than one longer anodic clean followed by an acid dip.

*Nickel Strike*

Following the final acid dip and rinse, the parts are placed in a nickel strike solution. The composition of this solution as used in this plant is as follows:

| | |
|---|---|
| Nickel sulfate | 16 oz/gal |
| Nickel chloride | 16 oz/gal |
| Boric Acid | 2.5 oz/gal |
| Acid | 0.3 normal or higher |

Temperature: Room Temperature
Current Density: 15 to 20 amp/sq ft
Time: 1 to 3 minutes

The composition as noted above can vary somewhat without noticeable effects. Since a rinse does not follow the nickel strike there may be a tendency to build up the chlorides in the bright nickel solution if the chloride is too high in the strike. This tendency will vary from plant to plant depending on the mode of operation. Therefore the chloride content of the nickel strike is controlled at a value which just keeps the chloride content of the bright nickel solution at a fairly constant value or at a slowly declining value. Continuous filtration is preferred along with cathode agitation. The solution should be free from organic addition agents and wetting agents, as well as metallic impurities, especially copper. A lead coil or lead in any form should not be left in contact with the solution for any appreciable time because of the high chloride content. A synthetic fabric such as Vinyon, Orlon or Dynel is preferred over cotton for anode bags.

The nickel strike has been used in our plant since early 1948 and has proven itself to be far superior to the copper strike. The most important feature of this strike is that it is capable of giving better bond between bright nickel and steel, which is of great importance on bumper guards. It has other advantages also. It requires considerably fewer tanks; one nickel strike tank instead of three or four tanks for the copper strike process. It is easier to control and is probably cheaper to operate. The objectionable use of cyanides is eliminated. Since this solution is operated at room temperature no steam is required and normally exhaust ventilation is not required. Considerable saving of equipment or better utilization of space can thus be achieved.

There are several prerequisites to the proper operation of the nickel strike. The acidity of the bath should be controlled fairly closely. It has already been mentioned that a rinse does not follow the nickel strike. It is preferred after nickel striking to go into the bright nickel with the work cathodic to obtain the best adhesion. This becomes of greater importance as the depth of the rack increases. Normally six volts or more are used until the rack is fully immersed at which time the current is adjusted to its proper value.

(*Continued on page 179*)

Look alike? Yes! — but what a difference in finishing costs. It cost a plumbing fixture manufacturer only $.0104 to finish the part on the right by Supersheen Speed Finishing. The part on the left cost $.25 to finish by former costly hand finishing methods. That's a saving of over 95% or $4,792.00 for 20,000 units. Supersheened finished parts maintained a much greater uniformity too.

WHAT IS YOUR FINISHING PROBLEM? Let us show you how Supersheen can save you a great deal of money. WRITE TODAY.

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**FREE** Mail coupon for this big, new 52-page catalog of money-saving finishing facts, figures, "before and after" photos. Learn the latest on equipment, compounds.

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Please rush me your new catalog "Supersheen Speed Finishing."

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# BETTER
## Barrel Zinc Brighteners

## PROMAT B4, B4M and B8

with

- High Brilliance and Depth of Color
- Excellent Covering and Throwing Power
- Low-cost Operation

Here's a simple, fast and *economical* method for producing brilliant zinc deposits on barrel work.

Promat B4, B4M and B8 Brighteners can be successfully treated with chromates, phosphates and other surface conversion coatings . . . are easily controlled, strike fast, cover well, and can be depended upon for uniform depth and brilliance of color.

. . . and there's more—most average cyanide zinc plating solutions can be readily and inexpensively converted to Promat B4, B4M or B8. Find out how, and why, these new brighteners can help ease your plating problems. Write for details.

**PROMAT** DIVISION

POOR & COMPANY

851 S. Market St., Waukegan, Illinois

# Branch News

## BRIDGEPORT

The Bridgeport branch of the AES held the annual Christmas Party in the main ballroom of the Hotel Barnum on December 11, 1954.

Upwards of 85 members and guests were on hand to enjoy the holiday festivities. The Broadway-type entertainment featured the debut of a new artist; our own **Bill Ehrencrona.**

The branch is most grateful for contributions from **Mike Tamas, Ray Goral, Floyd Tatum, George Haas, Walter Lynch, Bob Creamer, Ernie Reichenberg** and **Al Ferguson.**

BOB PARKER, *Secretary*

## BUFFALO

The Buffalo branch, AES, held its annual Christmas party at McVans' Night Club, December 9, 1954. After dinner, a drawing of prizes was held. The prizes were furnished by the suppliers to the plating industry. A floor show and dancing followed.

On January 7, **R. W. Couch** of United Chromium Inc. discussed, "Recent Development in Chromium Plating" covering the following subjects:

1. "Cold Chromium" plating baths for depositing chromium directly on aluminum.
2. "Crack-free Chromium."
3. Fatigue properties of chromium plated steel.

On March 4, 1955 **Howard McAleer** of Formax Manufacturing Co., Detroit, Mich., will discuss "Polishing and Buffing Compounds and Wheels."

ERIC G. SAMPSON, JR., *Secretary*

## CAPITOL DISTRICT

Members met at Panetta's Restaurant in Menands, N. Y., for an Italian style dinner at 7 o'clock, January 10. Librarian **Jim Stevens** introduced **A. S. Kohler,** Technical Director, Frederick Gumm Chemical Co., who came up from Kearny, N. J., to speak on "Barrel Burnishing."

Kohler presented his subject very well and illustrated it with sketches and samples that had been produced by burnishing and compared them with samples prepared by other methods. After his talk Kohler was kept busy answering questions from all quarters for at least a half hour. President **Infield** then called a business session. High lights of the session: President Infield lauded the efforts of the Christmas Party Committee; **Pete Greco, Ray Dunlevy, Mike Guarneri** and **Chuck Schenk.** A unanimous vote elected **James Barone** to membership in the branch. The president appointed **Ed V. Raymond** as Research Finance Chairman. Getting an early start, the following were appointed as the Committee for the 2nd Annual Spring Outing: **Norm Searles, Eric Berical, Len Brightman** and **Ed Frieberg, Jr.**

The new nomination committee was appointed: **George Kochem, Mert Johnston, Harry Millis** and **Bill Naylon.** Members were pleased to hear that **Ted Duvall** is progressing after his recent illness and is able to get out for brief walks daily.

After the close of the business session, **Ed Hollister,** Frederick Gumm Co., was host for refreshments.

PAUL D. CALLAHAN, *Secretary*

## CENTRAL MICHIGAN

The December 14 meeting of the branch was held at the Porter Hotel in Lansing.

The meeting was called to order by branch president **Fred Stuckenberg.** Librarian **F. Young** introduced the speaker of the evening, **R. D. Link,** General Electric Co. Link discussed the merits of the germanium rectifier as compared to the copper oxide and selenium rectifiers more commonly used as plating rectifiers. The speaker pointed out that the germanium rectifier is the latest development in d-c power supply for plating operations. This new type rectifier is considerably smaller for comparable output than either the selenium or copper oxide rectifiers. Link concluded his talk by listing a few advantages of germanium over selenium and copper oxide rectifiers including higher efficiency and smaller space requirements.

A film entitled "Clean Waters" on the problem of pollution of the existing water supply was shown, pointing out that the solution to the problem is a more adequate system of sewage disposal plants throughout the nation.

R. W. BOSS, *Publicity*

*(Continued on page 164)*


**COMPACT • PORTABLE • AUTOMATIC**

Sel-Rex JET PLATER

**A COMPLETE PLATING UNIT**

Consisting of

- **RECTIFIER** with automatic timer
- **TANK**
- **FILTER**
- **PUMP**
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**Designed for high speed, mass production precious metal plating or for use in the laboratory for any small-volume alkaline plating bath. Also ideal for use with a portable plating barrel. The JET-PLATER is equipped with a stainless steel tank but can be furnished with a rubber-lined or koroseal tank for acid plating solutions.**

**Standard models—10, 20, 30 gallon tanks, available with or without continuous filtration system. Other sizes to specification.**

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***Pioneers and developers of better gold, silver, nickel, copper, cadmium and rhodium salts and solutions.***




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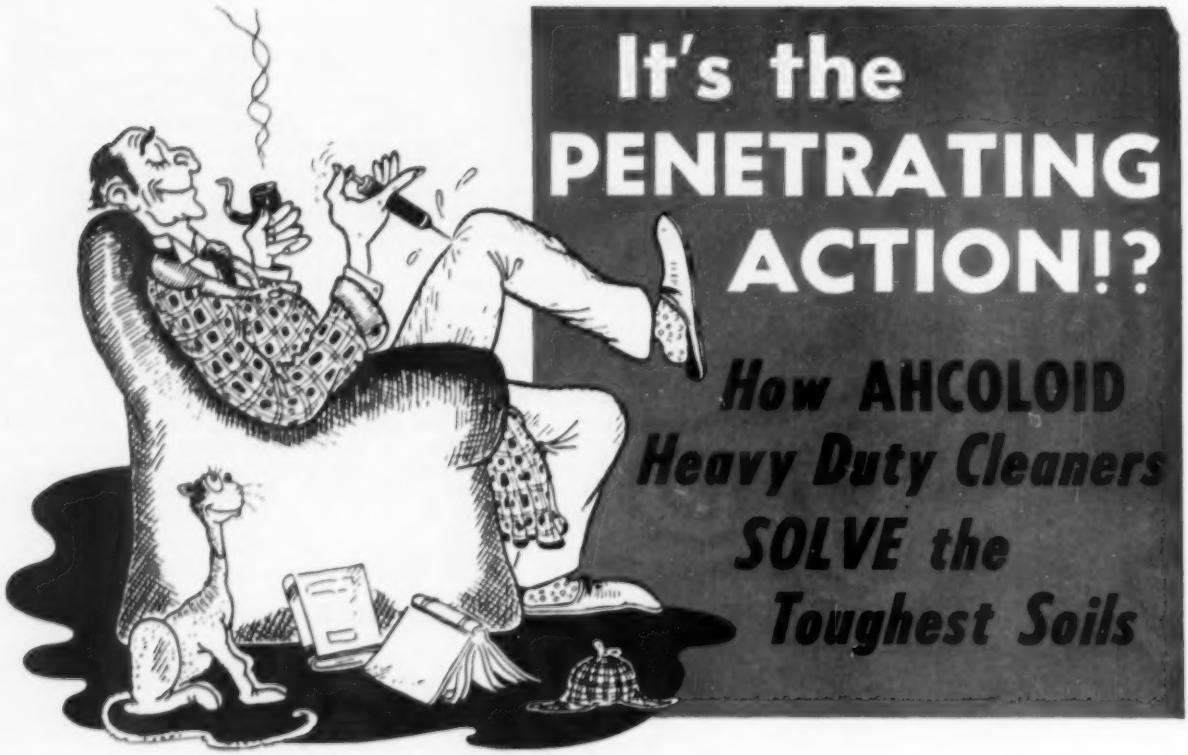


# It's the PENETRATING ACTION!?

## How AHCOLOID Heavy Duty Cleaners SOLVE the Toughest Soils

Sherlock Holmes knew a thing or two but he never dreamed of solving a case as fast as Ahcoloid Heavy Duty Cleaners solve cases of industrial soil! Drawing or stamping compounds, heavy oil or grease films, and industrial waxes come clean in no time when these fast-acting cleaners go to work. Whatever your cleaning problem, one of these cleaners is your best solution . . .

**AHCOLOID CLEANER 202-A**

This mild, low-pH soak cleaner is excellent for use on steel and most types of nonferrous metals, particularly to remove oily films with mineral oil base. Removes heavier oil films than most soak cleaners.

**AHCOLOID CLEANER 202-B**

Similar to 202-A but with higher alkalinity. Good to remove semi-solid, greasy, or waxy soils on steel and ferrous metals.

**AHCOLOID CLEANER 213-B**

This unique, low-pH soak cleaner is very mild . . . ideal on steel and stainless to remove drawing or stamping compounds and die lubricants with high metallic soap content . . . also drawing lubricants on phosphated surfaces.

**AHCOLOID CLEANER 215**

Economical soak cleaner for steel and nonferrous metals. Its low-foaming characteristic makes it ideal in tumbling equipment or for still tank processing. Many types of soil respond best to this cleaner.

Often cleaning problems arise from the unknown nature of the materials which cause the soil . . . why not submit your problem to our laboratory for testing and recommendations . . . without obligation.

CHECK AND MAIL TODAY

For more information about any of the above cleaners, check the appropriate box or boxes, clip, and mail to Apothecaries Hall Company, 22 Benedict Street, Waterbury, Connecticut.

202-A ☐ 213-B ☐

202-B ☐ 215 ☐

Apothecaries Hall Co.

# 25 years of service to the plating industry

1955 marks the start of our second quarter-century of leadership in the manufacture of anodes and chemicals for electroplating.

We enter the era with confidence and unbounded enthusiasm for continued expansion of the industry; determined to play our part well in its growth through producing highest quality anodes and chemicals, as well as offering sound technical advice to our customers large and small.

Our primary objective shall be unchanged — a sincere desire to serve those engaged in electroplating to the very best of our ability. New, improved products and processes shall always be foremost in our thinking.

**McGEAN ANODES AND CHEMICALS FOR ELECTROPLATING**

*brass*
*cadmium*
*chromium*
*copper*
*nickel*
*tin*
*zinc*

and McGEAN PROCESSES for BRIGHT NICKEL PLATING

**The McGean Chemical Company – 1040 Midland Building – Cleveland 15, Ohio**

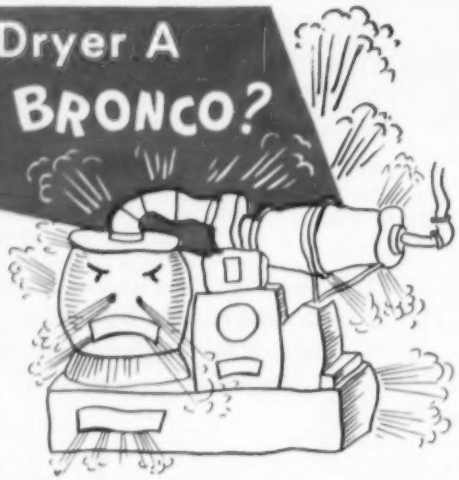
*leadership and service for 25 years*

McGEAN

## Branch News (Continued from page 161)

The Cincinnatti Branch of the AES convenes 71 strong to honor the ladies and past presidents


Is Your Dryer A BUCKING BRONCO?



In order for a centrifugal dryer to stay put it should be heavy. That's why the modern Nobles Dryer is about twice the weight of most dryers. Extra weight is one of the reasons for its stability, its freedom from vibration, its smooth operation, and long trouble-free life.

It's all new in design and principle. A powerful suction fan *draws* the air completely through this modern Nobles Dryer and exhausts it at the bottom! Electric or steam heaters are mounted in the cover of this machine of advanced design for a saving of space and elimination of heat loss.

Air moving equipment isn't an extra. The powerful suction fan is an integral design feature of each machine. A brake pedal extending around the entire work area controls an internal, expanding hydraulic brake for quick, smooth stops.

Why not take the first step now toward modern quick drying and lowest costs?

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Write Today for the FREE NOBLES DRYER BROCHURE


### CHICAGO

Chicago branch enjoyed its usual monthly meeting at the Western Society of Engineers on January 14, 1955. Following the business meeting, and dinner, **Dr. R. J. Rohr,** of the Mitchell-Bradford Chemical Company, Stratford, Conn., addressed the group on the subject of "Black Oxide Finishing." In addition to his fine academic background, Dr. Rohr is well known to Chicago branch members through his association with the Great Lakes Plating Company of Chicago, and more recently through his association with Mitchell-Bradford Chemical Company.

An announcement of the passing of one of the oldtimers after a prolonged illness was cause for sadness. **Ralph Leonard Shannon** who was born February 5, 1896 died on the fourth of December. He was for many years an active member of the Chicago branch.

Copies made from the transcribed proceedings of papers presented by speakers are now available at a cost of $1.00 per copy. These papers presented before the Chicago branch should be worthwhile additions to any library and the nominal charge is actually less than the preparation costs. Copies are obtainable from the secretary of the Chicago branch.

It was announced that the branch had contributed $700.00 to the Illinois Institute of Technology. This fund is for the purchase of equipment to be used in teaching electroplating.

JEROME KUDERNA,
*Publicity Chairman*

### CINCINNATI

The December 16 meeting combined Ladies' Night with recognition of Past Presidents of the branch. There were 71 members and guests present.

President **W. Gordon** took this occasion to alert the ladies to their responsibilities for the 1958 National Convention to be held in Cincinnati.

The following men were given Past President Pins, along with words of appreciation for their contribution to the club's growth: **Robert J. Knoepfler,** 1934–1942; **Harry Misner,** 1942–1943; **W. Ehlen,** 1944–1945; **August S. Schwering,** 1946–1947; **John F. Daymude,** 1947–1948; **Ezra A. Blount,** 1950–1951; **Robert D. Miller,** 1951–1953; **Carl H. Truman,** 1953–1954. Past Presidents **Bill Stoddard, Hank Nice, Bill Albohn** and **Fred Brune** were unable to attend.

The speaker of the evening was **Ollie James,** columnist for the Cincinnati Enquirer.

L. W. HOWALD, *Secretary*

### COLUMBUS

The December 3 meeting of the Columbus branch was held at the Columbus plant of North American Aviation.

Five new members elected into the branch were: **Dale C. Grau,** Westinghouse; **Paul T. Woodberry** and **Jack Spenard,** Battelle Memorial Institute;

## Branch News

**Peter Petroff**, Canton Platers Supply Co.; **John O. Cram** Pennsylvania Salt Mfg. Co.

Tri-state committee chairman **Bill Safranek** reported on the committee's progress and invited any interested member to attend the committee meetings.

**Gene Combs**, chairman of the 1955 convention committee, was among the guests present who reported on the progress his committee was making and the various changes to be made in the 1955 convention program.

MICHAEL FARR, JR.,
*Secretary-Treasurer*

### GRAND RAPIDS

The monthly meeting of the Grand Rapids branch was held on December 10, 1954 with approximately 50 members in attendance. President **Carl Green** opened the meeting by introducing the guest, **Warner Bloomenthal** of the AMI Company of Grand Rapids.

Librarian **Tom Henner** introduced Dr. **C. Fred Gurnham** head of Chemical Engineering Department of Michigan State College. Dr. Gurnham presented a discussion on "Electroplating Waste Disposal." He cited five main sources of pollution: natural pollution, agricultural, mining, municipal sewage and industrial pollution. Dr. Gurnham pointed out that every means should be used to eliminate waste by cutting down on waste formation.

Dr. Gurnham is presently working on a new book entitled PRINCIPLES OF INDUSTRIAL WASTE TREATMENT.

Following this talk, a movie made by G.E. entitled "Clear Waters" was shown. The movie brought forth the facts that 6,700 new sewage disposal plants are needed in this country and pollution is costing us over $200,000,000 a year.

KENNETH HAMPEL,
*Publicity Chairman*

### INDIANAPOLIS

Forty-one members and guests attended the December 1, 1954 meeting at the Fox Steak House.

**Quentin Shockley** reported on the annual dinner-dance.

**Herb Kennedy** reported on the tri-state meeting at Columbus, Ohio in March.

Under new business the following were elected as delegates to the national convention: **Abraham Max, Quentin Shockley** and **Edna Rohrabaugh.** The alternates are **John Hood, Walter Gulleson** and **Bert Hawhee.**

It was suggested by the committee that an article be prepared for PLATING.

Information was asked about rules and regulations for a display at the next national convention. The committee will have a report on this matter later.

A talk was given by **John Swift** of Swift Chemical Company on "What a

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Federated Metals has them all:

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| Lead (including our famous Conducta-Core anode) | |
| Cadmium | Copper |
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All conventional sizes and shapes can be supplied. Good service, too, from specialized distributors in your area.

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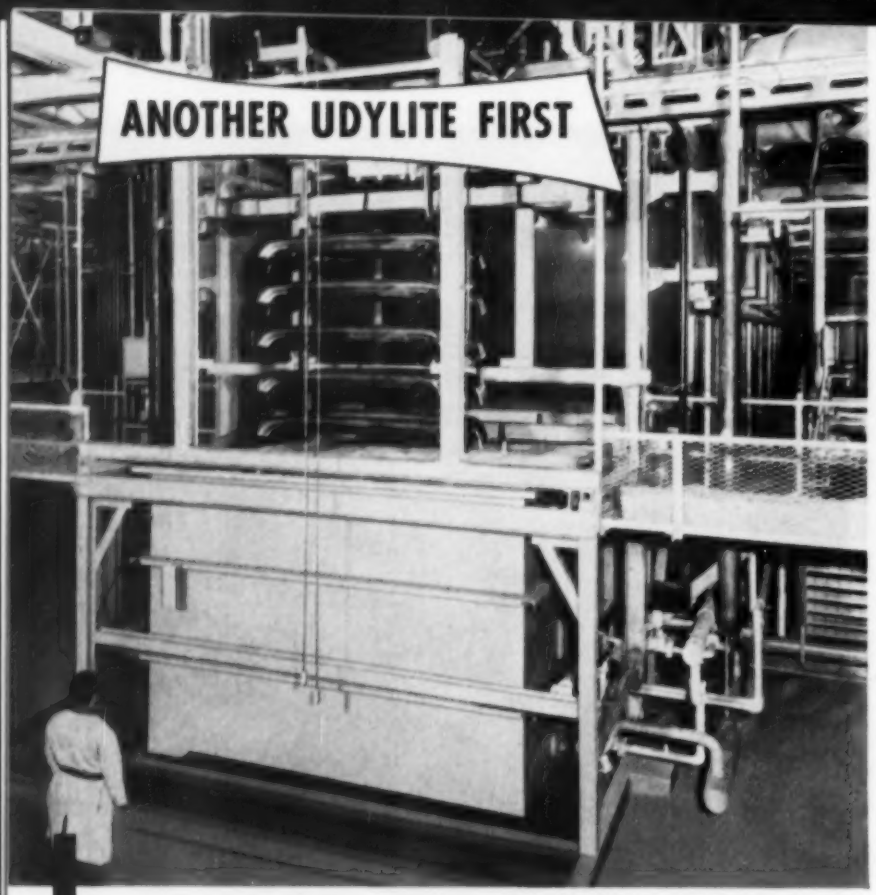


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### *Udylite Selective Cell Plating Machine Electroplates 360 Automobile Bumpers Per Hour*

Today in one of the nation's largest automobile plants, bumpers are being copper, nickel, chrome plated with a quality of finish and efficiency of operation unmatched by any other method. This work is being done on a new automatic electro-plating machine—a product of Udylite research—which incorporates features exclusive in Udylite equipment.

The Udylite design allows for automatic selection of empty plating cells as the racks emerge from preceding operations. As they drop into the cells they fit around anodes in the tank that are hung to conform with the shape of the bumper. This assures quality plate on all curved surfaces. Efficiency in rack utilization is also a feature, for of the 84 racks used for the machine, only four are out of service during the normal plating cycle.

Udylite builds plating and metal finishing machines large and small. The Udylite Full Automatic was the first standardized plating machine ever offered to the industry. It brought economy, high production and process control at a low installation price.

If you have a plating problem it will pay you to consult Udylite. Write to:

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WORLD'S LARGEST PLATING SUPPLIER

## *Branch News*

Plater Should Know About Metallurgy."
EDNA ROHRABAUGH, *Secretary*

### LOUISVILLE

The November 18 meeting was held at Kapfhammer's Party House with 26 members and guests present.

Three applications for membership from **Kenneth Buse, Duke Scott** and **Meloin Mathews,** and one application for transfer from the Los Angeles branch from **Charles H. Wirth** were accepted.

The speaker of the evening, **Elmer Rehem,** United Chromium Corp., was introduced by Librarian **Stanley Beyer.** Rehme spoke on "Hard Chrome Plating," and presented slides of charts and plated specimens showing comparative efficiency, hardness, and appearances of deposits made with conventional chrome plating bath and the United Self-Regulating High Speed Bath. A considerable interest was shown through questions by those present, and Rehme was complimented for his able presentation.

ARTHUR A. OERTEL,
*Acting Secretary*

### NEWARK

The meeting of the Newark branch was held December 17, 1954, with all officers present except **George Reuter.**

Applications were received from **Paul J. Topelian,** Tiarco Corporation; **Harold C. Kelshaw,** Harold C. Kelshaw Corp.; and **David R. Siversten,** Bendix Aviation Corp. The following were elected to membership: **Henry J. Borkowski,** Wallace & Tiernan; **Herbert Brown,** Beacon Supply Co.; **Harry De Bruyn,** F & B Metal Plate; **Irving Katz,** Automatic Methods, Inc.; **Sanford Neuhaus,** Aurilyte Process Co.; **James P. McNally,** Bart Mfg. Co.

**John Banta** moved that a resolution be drawn up to be submitted to the proper state authority expressing the interest of the Newark branch in the water supply situation for the North Jersey area and urging that steps be taken to assure an adequate future supply. Seconded by **D. Foulke** the resolution passed with **John Gumm** instructing Banta to draw up such a resolution for approval by the branch at the next meeting.

Librarian **Clifford Struyk** introduced **Robert Ehrhardt** who discussed alloy plating. He reviewed the various alloys plated, briefly touched upon the theory of alloy deposition and predicted increasing use of alloy deposits.

**Dr. George Dubpernell,** United Chromium, Inc., then presented the principal paper of the evening—"Isaac Adams, Jr., Pioneer of Nickel Plating." By word, picture and exhibit the early history of nickel plating was developed about the person of Adams who actually devel-

## *Branch News*

oped nickel plating to a commercial standing in the United States and Europe.

D. GARDNER FOULKE,
*Recording Secretary*

### NEW HAVEN

The regular monthly meeting was called to order by President **Edward F. Busby** on November 9, 1954 at the Mason Laboratory, Yale University. The attendance was the best of the season and included guests from both the Hartford and Waterbury branches.

The membership committee report by **Harry Taylor** cited the personal contact activity that is starting to show results. He appealed to the entire membership to get into the drive in a personal way.

Technical Chairman **Walter Lynch** then introduced the speaker of the evening, **Allyn D. Chabot** of the Detrex Corp., who gave an interesting talk on "Ultrasonic Cleaning." He used a one kw demonstrating unit and the lively question and answer period attested to the success of the evening.

After the drawing for a door prize donated by **Al Ferguson** of MacDermid Inc. the meeting was brought to a close.

B. J. GAFFNEY, *Secretary-Treasurer*

### PHILADELPHIA

The regular meeting held at the Engineers Club on December 10 was preceded by a dinner and attended by 40 members and guests. The speaker was **Dr. Abner Brenner,** National Bureau of Standards, whose topic was "Electroless Nickel." He gave the history of the commercial development of the process and discussed the advantages, disadvantages, specialized applications, equipment, chemistry and other details of this unique method of plating without current.

Nine new active members were elected. A motion was passed that ASTM specifications on plating materials were desirable but not necessary.

**J. S. Sanyal,** a member of India productivity team visiting the United States from Calcutta, told of the cooperation he was receiving in this country.

I. WM. MARCOVITCH, *Secretary*

### PITTSBURGH

A record for both dinner guests and attendance at a regular meeting was set at the Pittsburgh branch monthly meeting held at the Sheraton Hotel's Avalon Room January 5.

We were honored to welcome three new members into our branch, **C. H. Walton, W. G. Sittmann,** and **M. A. Petrucci.** A total of 46 members surprised **Ryan,** Sheraton caterer, for dinner, but as usual he rose to the occasion. For the meeting there were 76 members and guests. This large attendance is easily attributed to the speaker of the evening.

*(Continued on page 172)*



INDICATE A 238.

# CHROME PLATERS ACCLAIM ZERO-MIST

***New Udylite Additive Provides Absolute Control of Chromic Acid Mist and Spray***

If you are a decorative chrome plater you will save valuable chromic acid now wasted in dragout, mist and spray by using Udylite's new Zero-Mist in your chrome plating solution. You will improve the hygienic conditions in your plating room, too!

Zero-Mist is a completely stable additive, indestructible at all temperatures and in all concentrations. It is easy to maintain in the bath. Its control is simple. It lasts and lasts.

Since the introduction of Zero-Mist less than a year ago by Udylite, hundreds of users have written acclaiming the benefits of this fine new product.

Here are a few comments . . . "70% reduction in chromic acid use" . . . "29% reduction in cost" . . . "considerable reduction of chrome dragout" . . . "satisfactory in keeping down fumes and spray" . . . "If necessary could turn off exhaust system" . . . "Our chromic acid usage cut more than 50% and our fume problem eliminated" . . . "Zero-Mist reduces film dragout."

Write for a free folder describing the usage and characteristics of Zero-Mist or enter a trial order today. Write to:

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# Entirely New Filter Design

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**Gives You Double Value**

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| DOUBLE VOLUME | New Sel-Rex Annular Type filtration principle *doubles* filtration area and volume *without increasing size of unit.* |
| DUAL PURPOSE | Designed for efficient low-cost operation with either cloth bag or porous stone. |
| EASY OPERATION and MAINTENANCE | • Entire filter element secured to tank cover . . . simple inspection and cleaning.<br>• Extra capacity precoat tank.<br>• Colored operating valves located at front of unit permits operation of unit by unskilled help.<br>• All hose connections are horizontal — eliminates danger of leaks and ruptures.<br>• Special T-valve permits clean changeover from precoat to filtering. |

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Sel-Rex Filters available in standard sizes (Portable or stationary models) to 175 sq. ft. area. Larger units designed to specifications.

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# *avoid stream pollution due to chromium waste...*

## ...with W&T Sulphur Dioxide Reduction Equipment

With the proper treatment equipment, toxic hexavalent chromium can be reduced by sulphur dioxide to the trivalent form and then completely precipitated by alkali for standard removal to a disposal area — such as a lagoon. After this treatment the waste water can be drawn off and safely disposed of in the usual manner. This treatment is in full compliance with most local and state pollution abatement laws.

Wallace & Tiernan offers the heat treating and metal finishing industries several types of Sulphur Dioxide Feeders with optional controls for manual, semi-automatic or fully automatic operation. These feeders are adaptable to either the "batch" or "flow-thru" methods of treatment in both large and small plants.

Similar equipment is also available for the destruction of cyanide waste by alkaline chlorination.

W&T offers PROVEN EQUIPMENT — hundreds of similar units are serving industry today, EXPERIENCE — over forty years of building chemical feeding equipment, and SERVICE — field representatives are located in principal cities throughout the country.

Write today for additional information on W&T Sulphur Dioxide Feeders and Alkaline Chlorination Equipment, at no obligation to you, of course.

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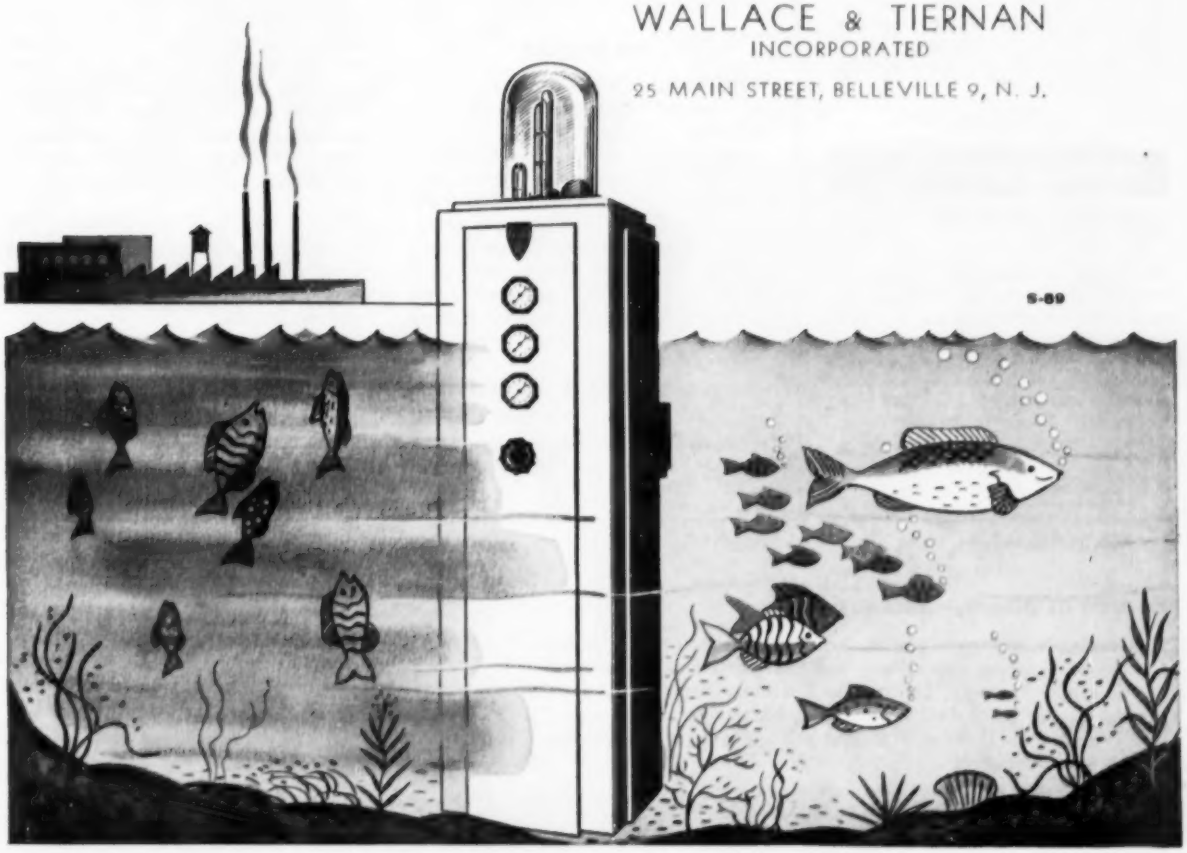

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# Cuts Chromium Salts Consumption by 50%

## *Plant saves money while it improves results with Unichrome SRHS Chromium Plating Solution*

### MATERIALS FOR ANY STOP-OFF JOB

Any plater who has a job for stop-offs has a ready source of information on all important types in United Chromium. Available are wax-type materials which can be reclaimed; lacquers which apply easily and dry fast; tape for fast, snug wrapping. Plastisol compounds, too, for molding into stop-off shields. Even a stop-off for nitriding and carburizing operations – Unichrome Pyrophosphate Copper Plating, which many companies consider the outstanding process for this job.

### HELPFUL HINTS

***by "Mr. Cost Cutter"***

With the new sprayable Unichrome Plastisol Coating 5300, platers can apply a *seamless* coating, and insulate and protect tanks. One large automotive company got this protection on both inside and outside of electrocleaning and rinse tanks for less money than formerly spent just for interior linings built up from sheet materials.

RESULTS achieved by an automotive company tell another story of major improvement in chromium plating operations.

The advantages of the Unichrome SRHS Chromium Plating Solution were first carefully checked by this company's critical research division. Shortly thereafter, on the basis of the test results, the SRHS solution replaced the ordinary solution in a fully automatic plating machine.

#### THE RESULTS

All benefits were confirmed. Loss by dragout dropped since the new solution was more dilute. Loss by spray carried off in the ventilators diminished because the higher efficiency of the SRHS bath reduced the wasteful gassing which causes spray. In fact, records reveal that consumption of chromium plating salts used to maintain the bath was cut *more than half*. In addition – faster plating speed was obtained; also brighter deposits, and better coverage.

This company now has every chromium plating tank in the plant working with, and saving with, Unichrome SRHS Chromium.

#### OTHER ADVANTAGES PLATERS LIKE

SRHS Chromium presents platers with a bath where important constituents are automatically controlled for best plating balance. This assures a more foolproof operation and helps reduce rejects. Moreover, the bath provides the easiest and most economical way to increase plating capacity – inasmuch as it cuts plating time as much as half, and needs less power to plate a given work load.

Write for Bulletin SRHS-2 for more details. Or better yet, ask for a United Chromium engineer to survey your requirements and offer recommendations.

**UNITED CHROMIUM, INCORPORATED**

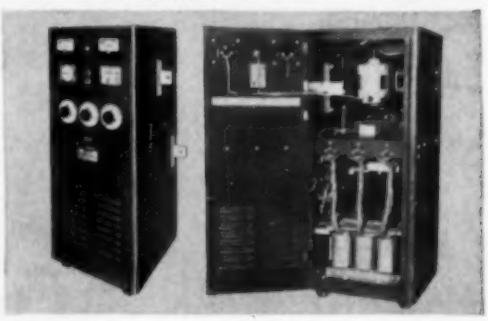
**100 East 42nd Street, New York 17, N. Y.**

**Waterbury 20, Conn. • Detroit 20, Mich. • Chicago 4, Ill. • Los Angeles 13, Calif.**

**In Canada: United Chromium Limited, Toronto 1, Ont.**

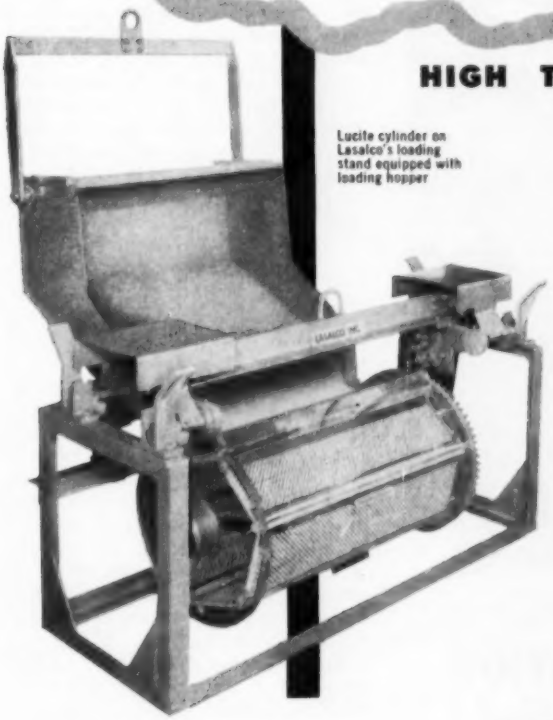
### Source of power—and savings

Equipment for complete plating installations supplied by United Chromium is, from experience, designed for efficient operation and genuine economy. Unichrome Rectifiers, for example, are unusual in design of rectifier stacks, transformer ratings, wiring and insulation details – giving long service at high efficiency in plating and anodizing.



# Does The Complete Plating Job In A Single Cylinder!

## HIGH TEMPERATURE LUCITE CYLINDER



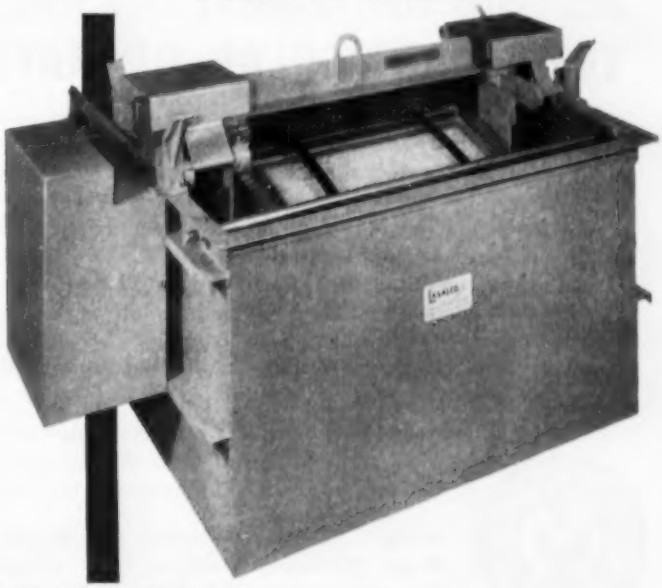
Lucite cylinder on Lasalco's loading stand equipped with loading hopper

- Eliminates work transfers—carries the work from start to finish—speeds up plating operations—lowers production and equipment costs
- Remains impervious to all usual plating solutions
- Lasts indefinitely when used in temperatures up to 170°
- Full length 1-piece negative connection gives perfect contact. Heavy dangler imbedded in load
- Negative contact can be arranged to carry up to 800 amps
- Quick, unobstructed loading and unloading. One-piece door has instantly removable positive-locking clamps
- Rugged construction of ½" thick Lucite. Annealing after assembly prevents all internal stress
- Capacity up to 150 pounds

Cylinders available in 24", 30", 36" and 42" lengths. Inside diameters 12" or 14" across flats.

## RICHARDS BARREL PLATER

### with LUCITE CYLINDER



- Knife switch contacts are entirely self-cleaning when cylinder is lowered into place.
- Cylinder knife switches insulated and protected by guard from overhead drippage.
- Multiple units for tackle hoist operation. Single units either tackle or hand hoist.
- Motor-driven gear drive has 3-speed selector for 2-4 and 6 r.p.m.
- Nothing plates but the load! A real money-maker that does a better job in less time at lower cost.

*Write For Catalog Page*

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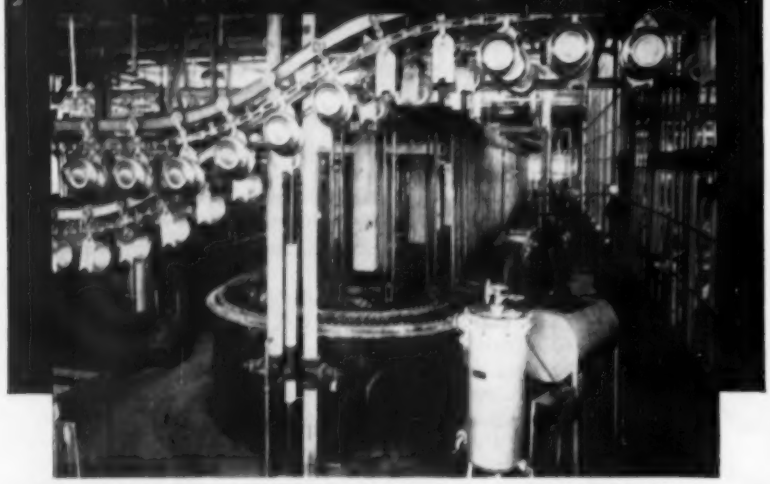
# MEAKER ENGINEERED Plating Equipment



## DESIGNED FOR HIGHEST EFFICIENCY in YOUR PARTICULAR OPERATION

MEAKER puts engineered efficiency into its line of plating, anodizing, phosphatizing, and other processing equipment. MEAKER engineers will help you determine what specific kind of equipment you need . . . and then see that you get it! Whether you need standard or special, fully automatic or batch type, straight-away or return style, through MEAKER'S recommendations you can be *sure* of getting the ideal installation for your particular process. Many years of experience designing and constructing plating equipment for some of the nation's top industrials has given us the technical ability that assures you the utmost in efficiency—high production plating at low unit cost.

Call or write today and have a MEAKER representative survey your problem with you at no obligation. You may be pleasantly surprised at the results.

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***Write, Wire or Phone for Details on How Meaker Service Can Help You Toward Better Plating at Lower Cost.***

THE MEAKER COMPANY

1633-41 SOUTH 55th AVENUE • CHICAGO 50, ILLINOIS

Phone OLympic 2-2110


## *Branch News*

After a short business meeting our librarian introduced this magnetic speaker, **Dr. L. P. Gotsch,** Associate Director of Research and Technical Service for American Can Company. Dr. Gotsch talked on the "Quality Aspects of Electrodeposited Tin Coatings Important to the Manufacture of Containers." He traced the rapid development of electrodeposited tin since the last war, the tremendous surface area covered, how extremely thin tin coatings differ from other commercial coatings, and the scope of the problems involved.

After a brief pause for refreshments Dr. Gotsch drew the name for the monthly door prize. **James R. Crain** of Westinghouse was the winner of a Sunbeam electric iron (they use P. R. copper anyway) presented by **Charley Churchill** of Cowles Chemical Co.

HERB SCHRAM, *Secretary*

### PORTLAND

The December 13 meeting was called to order by president **H. Finzer** with 15 members and guests present.

The following were elected to office for the year 1955: president, **Harold Burkitt,** Industrial Chrome Plating; 2nd vice-president, **Royce Case,** Sawyers Inc.; 3rd vice-president, **Darrel Anderson,** American Denure; secretary-treasurer, **Ken Humphrey,** L. H. Butcher Co.

The group gave Herb Finzer a round of applause for his continued efforts as president of this group and agreed that his work has been instrumental in giving the group a good start.

The speaker for the evening was **Dan Boone,** W. P. Fuller Co., who spoke on "Paint and Lacquer Coatings on Metal," and described various types of painted coatings, their primary purposes and corrosion resistance.

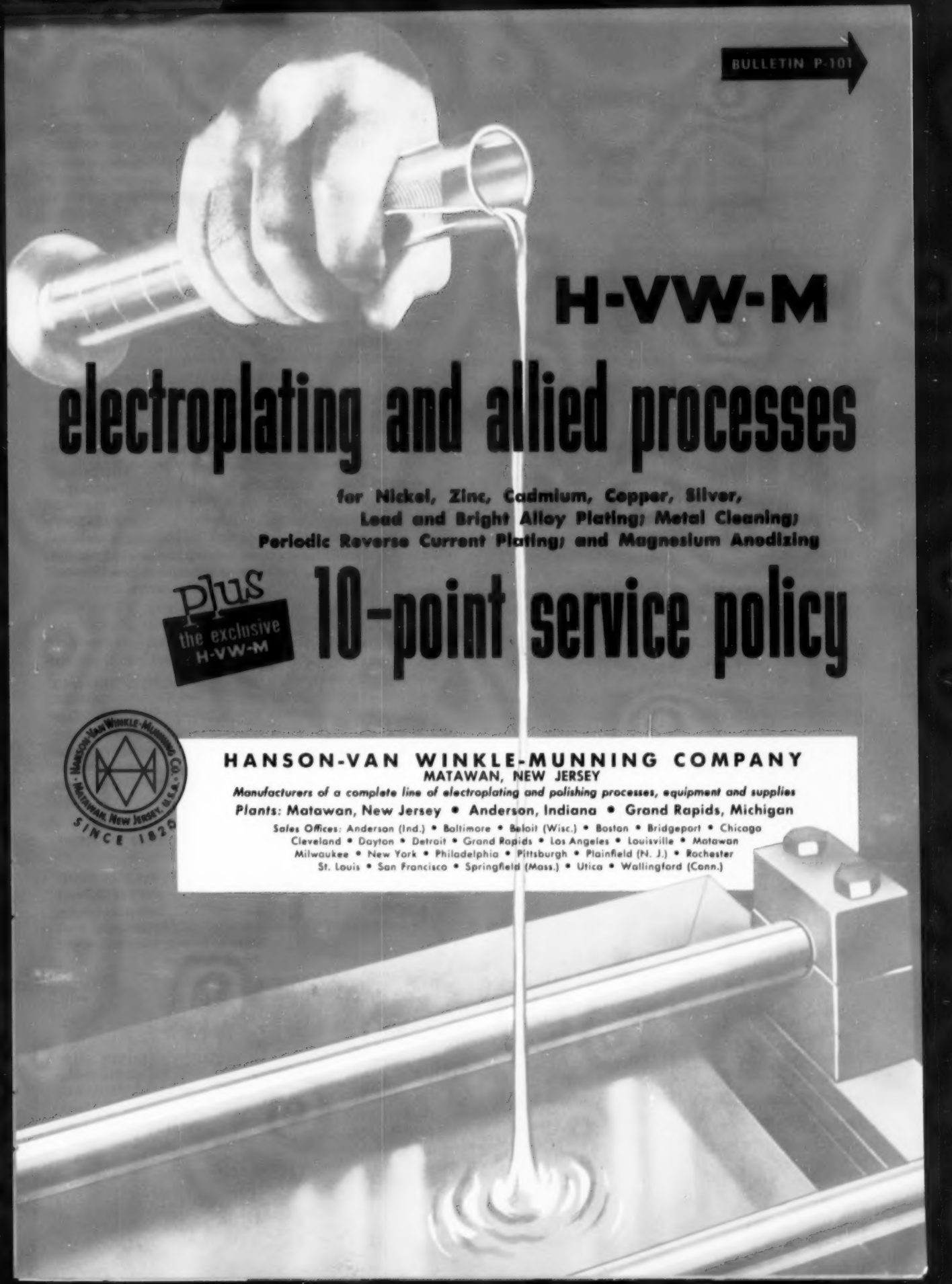
KEN HUMPHREY,
*Secretary-Treasurer*

### ROCHESTER

The annual Christmas party of the Rochester branch was held on December 17 at the Liederkranz Club, Rochester. A fine evening was enjoyed by members and guests who attended. Thanks to the generosity of our suppliers, a large number of door prizes were distributed.

After the dinner, President **Ed Wallin** awarded a parchment scroll of honorary membership to **Ray Berghold** of the Rochester branch for his untiring efforts during his many years as a member. Ray has been an active member of the Rochester branch of the AES for approximately 20 years and is a past president. Ray has been employed by the Frederick Gumm Chemical Company for 16 years, retiring the first of the year. Representatives of the Frederick Gumm Chemical Company who attended the party were

(*Continued on page 190*)


BULLETIN P-101
H-VW-M
electroplating and allied processes
for Nickel, Zinc, Cadmium, Copper, Silver,
Lead and Bright Alloy Plating; Metal Cleaning;
Periodic Reverse Current Plating; and Magnesium Anodizing
Plus
the exclusive
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10-point service policy
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MATAWAN, NEW JERSEY
Manufacturers of a complete line of electroplating and polishing processes, equipment and supplies
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SINCE 1820

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## They are backed up with SERVICE

**They cost no more—but you get more when you buy these processes . . . behind every one are H-VW-M's exclusive 10 points of complete electrochemical, electrical and mechanical service.**

**SERVICE** **PERIODIC ANALYTICAL SERVICE** . . . a quality control measure—samples of customers' processes regularly checked in H-VW-M laboratories.

**SERVICE** **COMPLETE FINISHING SEQUENCE RECOMMENDATIONS** . . . with each process application, thorough data on proper polishing, buffing, pickling, plating and after-treatments.

**SERVICE** **CUSTOMERS' PRODUCTS PLATING LABORATORY** . . . complete laboratory facilities available for trying out various processes on customers' products.

**SERVICE** **PLATERS' TRAINING COURSES** . . . at no obligation to customers, plating personnel may receive thorough analytical and process training in H-VW-M laboratories.

**SERVICE** **PLATING PLANT LAYOUT SERVICE** . . . expert assistance in planning most efficient plating installations and use of facilities.

**SERVICE** **TRAINED SALES REPRESENTATIVES IN ALL PRINCIPAL AREAS** . . . immediate assistance on any plating problem is only a phone call away from any customer's office.

NICKEL-LUME TYPE I—A perfected organic-type bright nickel process featuring: extreme deposit brilliancy with good ductility and high activity; excellent solution characteristics—stability, easily controlled, low cost operation.

NICKEL-LUME TYPE II—Similar to Type I, but designed for air agitation for highest plating speeds and/or heavy deposits.

NICKEL-LUME BRIGHT BARREL—Similar to above, but designed for use in mechanical plating cylinders. High ductility and activity permit subsequent chromium plating if desired.

9-H COBALT-NICKEL—A time-tested bright nickel process not dependent on organic addition agents for highly brilliant deposits. Properly installed, it is outstandingly stable, producing deposits with good physical properties and unsurpassed protective value.

NICKEL **(Sulfamate)**—A sulfamate salt process for producing heavy, smooth deposits with superb physical properties. Bath developed especially for build-up of nickel deposits of several thousandths and more. Ideal for electroforming and electrotyping operations.

BLACK NICKEL No. 1—A prepared salt mixture for producing a decorative gray-black gunmetal finish.

BLACK NICKEL No. 3—Produces a deep-black decorative finish on copper, brass and nickel-plated steel. Also for obtaining black background on brass or aluminum name plates. Used for immersion black on zinc die-castings or zinc-plated parts.

BBZ-201—For bright zinc plating in barrels. Produces zinc deposits ranging from silvery-bright to a brilliant bluish-white appearance directly from the bath. Bright dipping is optional.

BSZ-300—An economical, high current-density process producing brilliant zinc deposits from still tanks and conveyors. Deposits readily accept conversion coatings.

CADUX HS—Produces brilliant, pure cadmium deposits at high plating rates in still tanks, conveyors and mechanical cylinders. A bath highly stable and tolerant to impurities.

WES-X COPPER—Smooth, brilliant deposits free from co-deposited organic brighteners. Exceptional corrosion protection, good physical properties and marked leveling when periodic reverse current is employed.

SILVER-LUME—The process that has changed long-standing concepts of silver plating. Produces brilliant and mirror-like silver deposits direct from the plating solution, satisfactory in many cases without subsequent buffing.

Bath has exceptional throwing power. Deposits are hard and wear-resistant, with high protective value, and are somewhat more resistant to tarnish than ordinary silver deposits.

S-B ZINC—An all-purpose zinc bath producing satin-bright to full bright deposits (depending upon solution composition and operating conditions). Has remarkable throwing power and high surface activity for subsequent surface conversion coatings.

SUPER-PROTECTO LEAD PLATING—For applying heavy lead deposits at moderately high current densities in still tanks, barrels and automatic equipment. Furnished in the form of a liquid concentrate.

ALBALOY PLATING **(Bright Alloy)**—Ternary alloy deposits (approx. 55% copper, 30% tin and 15% zinc). Deposits are silvery-white and bright, have high tarnish resistance, have excellent corrosion protection properties, are highly reflective (85% of silver), are relatively hard (Rockwell 50C) and are easily soldered. Melting point is approximately 950°F.

Recommended on copper or copper-bearing nonferrous materials. On electrical instrument parts, because of high tarnish resistance, has ease of soldering and corrosion-protective qualities. Non-magnetic and abrasion resistant. Useful at ultra-high frequencies because of combination of properties. Used as a protective and decorative coating on beryllium copper springs.

METAL CLEANING PROCESSES—Alkaline, acid and emulsion cleanser products to meet any metal cleaning requirements. A full selection for soak cleaning, electrocleaning, horizontal barrel cleaning, oblique barrel cleaning, spray washing machine cleaning and for special cleaning applications.

PERIODIC REVERSE CURRENT—H-VW-M is the sole agent for marketing the Periodic Reverse Current Process. Competent technical assistance is available from H-VW-M for applying PR current to metal plating operations.

MANODYZ PROCESS—A process for the anodic treatment of magnesium to produce a corrosion-resisting coating. All alloys can be treated by either the a.c. or d.c. modifications. Coating can subsequently be painted or dyed to various colors.

***Complete information on individual H-VW-M processes is available in bulletin form.***

**SERVICE**

**NATION-WIDE TECHNICAL SERVICE**

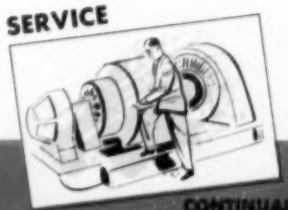
. . . field electrochemists available for on-the-spot technical assistance all over the country.

**SERVICE**

**LABORATORY APPROVAL FOR ALL PROCESS PRODUCTS**

. . . *all* chemicals, addition agents, and anodes for H-VW-M processes must pass rigid laboratory tests before being sold—your guarantee of consistently high quality.

**SERVICE**



**CONTINUAL TESTING OF ENGINEERED EQUIPMENT**

. . . all H-VW-M electrical and mechanical products continually tested *in use* with processes to check and refine performance characteristics.

**SERVICE**

**CONSTANT DEVELOPMENT AND RESEARCH**

. . . *all* H-VW-M processes continually tested to improve existing results and develop new, more efficient products, processes and procedures.

**PLATEMANSHIP**

Your H-VW-M combination — of the most modern testing and development laboratory — of over 80 years experience in every phase of plating and polishing — of a complete equipment, process and supply line for every need.

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Anodes
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Barrels, Burnishing
Barrels, Tumbling
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Basket, Scrap Anode
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Chrome Spray Floats
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Compositions
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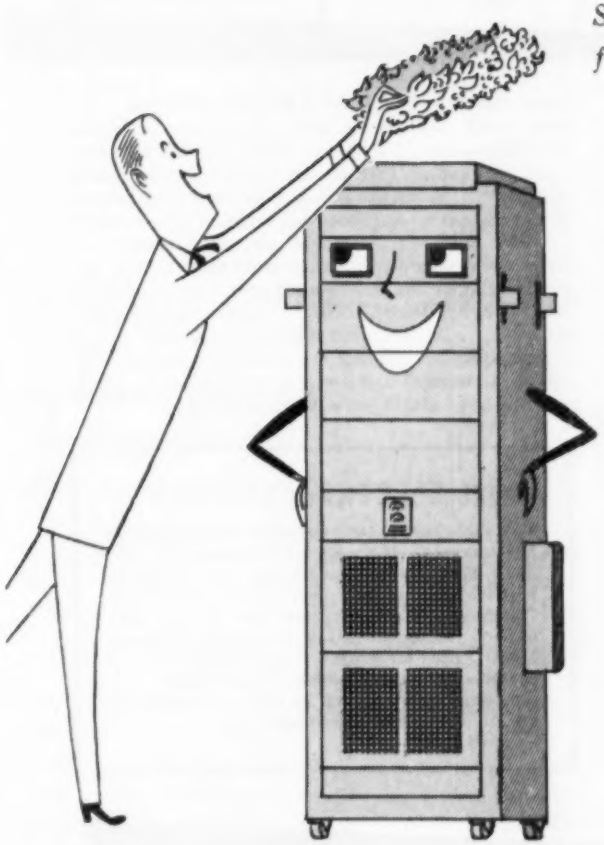
# DID YOU KNOW?

## NEARLY EVERY FEATURE NOW AVAILABLE ON ELECTROPLATING RECTIFIERS WAS ORIGINATED BY GREEN ELECTRIC — AND MOST OF THESE OVER A DOZEN YEARS AGO



*Some of the standard and special features in Munning-Green Rectifiers:*

- Skyscraper cabinets to save floor space
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- Meters and lamps at eye level
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- Twin pairs of output terminals
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- Automatic ampere-hour control
- Automatic time control
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- Detailed instruction book
- Unconditional two-year guarantee

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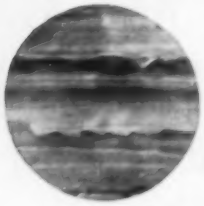
# Battelle Electropolishing
## and electrodeburring

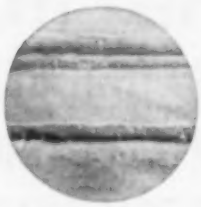
### what will it do?

### here you see for yourself...

A 10,000-times-magnified steel surface cut up by abrasive polishing. Next you see it burnished, with slight improvement; and then the smooth, lasting beauty of the same surface electropolished.



**FROM THIS...**
(ABRASIVE POLISHED)
like a ploughed up field



**YOU GET THIS**
(BURNISHED)
slightly improved

**...OR THIS**
(BATTELLE ELECTROPOLISHED)
smooth, lustrous, sales appeal

## What are the special advantages?

Extraordinary smoothing action produces a micro-polished effect . . . "true metal color" is achieved with a luster not attainable by belts or wheels . . . a wide range of finishes is available . . . plating and enamel adhere better . . . your metal is not surface damaged . . . this all adds up to *product upgrading, new sales values.*

Chemical stability is assured because there are no organic agents to break down . . . process control is easy with all components checkable by direct analysis . . . operations are readily handled by semi-skilled help . . . many types of steel can be treated in the same solution . . . changeover is simple and inexpensive.

## What products, what metals can be electropolished?

Automotive trim, aircraft components, appliances, refrigerator and stove trim and parts, kitchen ware, jewelry, tools, wire goods, tubing, plumbing fixtures, hardware, machine parts, and hundreds of other items can be electropolished. Turbine buckets and compressor blades are especially adaptable to electropolishing.

These metals and alloys can be electropolished: . . . Many steels, low-carbon and high-carbon . . . many low-alloy steels . . . stainless steels in 300 and 400 series and other special compositions, particularly 18-8 and 17 chromium stainless steel items. *On stainless steels, electropolishing will produce an especially desirable finish* . . . Wrought aluminum alloys . . . certain non-silicon-containing aluminum casting alloys . . . copper and beryllium-copper alloy . . . Monel . . . Nickel . . . Nickel-silver . . . Bronze (single phase alloys) . . . Brass (non-leaded compositions, single phase alloys) . . . Turbine bucket alloys (Nimonic 80, S-816, and others) and compressor blade alloys (such as AMS 5615 and Type 430 stainless steel).

## About ELECTRODEBURRING

This variation of electropolishing is indispensable for smoothing sharp, burred metal for safe handling and precision functioning. The metal can be steel, stainless steel, copper, brass, aluminum. Electrodeburring is ideal for parts having burrs in hard-to-reach areas. For some items electrodeburring plus electroplating produces the best possible and most economical finish. Equipment, solutions and procedures for electrodeburring are similar to those for electropolishing.

For more information about ELECTROPOLISHING and ELECTRODEBURRING write any of these distributors.

They are fully equipped to help you technically—will send you the new folder, FINISHING—WITH A PROFIT, which also describes other Battelle-developed processes.

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Why sure we can make the change in specifications. What are They?

## Bumper Guards

(*Continued from page 159*)

*Nickel and Chromium Plating*

The bright nickel solutions are continuously filtered with a turnover of about once every hour. The cathode rods are agitated to help in the speed of the deposition and rate of brightening.

After nickel plating, the parts are rinsed twice and chromium plated. Following the chromium plate the guards are rinsed in cold water with a spray rinse as they emerge. A hot rinse follows.

The guards are unracked and the empty racks are placed in an alkaline chromium strip with reverse current to remove the chromium from the contact points of the racks. The racks are then rinsed and immersed in a spent muriatic acid high in iron salts to react with any chromium still left or trapped on the rack. After another rinse the racks are ready to be loaded again.

Since very little nickel plate is deposited on the inside of the guards, usually a fast drying aluminum lacquer is sprayed on the inside to keep that area from rusting. Because of limitations of nickel thickness, some parts in recent years receive a thin coating of an industrial clear wax emulsion to further increase the corrosion resistance of the deposit. This type of coating gives good salt spray resistance and if allowed to remain on the parts long enough, helps to prolong the life of the finish.

*Use Approved*

**SEELEY COMPOUNDS**

**for**

**Preferred Metal Finishes**

**E. E. SEELEY COMPANY, INC.**

*Buffing Compounds*

**Bridgeport 1, Conn.**

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- *Fast*
- *Clean*
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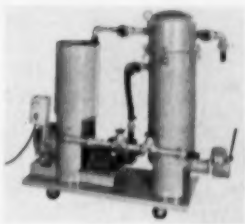
Eliminate costly maintenance of cleaning filters by backwashing. This new one minute cleaning operation will save you $$, time and trouble.



**PERMANENT FILTERS FEATURED**

- *No Bags*
- *No Sheets*
- *No Pads*

Handles volumes from 350 to 15,000 gph. Stainless steel filters do not swell or change shape, and will handle both acid or alkaline.

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**STEADFAST INDUSTRIES INC.**

4731 W. Madison St., Chicago 44, Ill.

*(In Canada, write Armalite Co. Ltd.)*

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# PRODUCTION FINISHING

**Production finishing demands not only high output at low unit cost, but also a uniform finish meeting required standards. Acme Automatics can be depended upon to deliver high production at minimum cost and maintain your finish requirements. Acme performance has been proved in production for nearly half a century.**

**POLISHING and BUFFING**
**DE-BURRING**
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**MICRO-FINISHING**

**ROTARY *Automatics***
**STRAIGHT LINE *Automatics***
**SEMI-*Automatics***
**Catalogs on Request**

### *Recommendations & Quotations*

***For recommendations, send blue prints of part or samples before and after finishing operations, together with detailed information on finishing operations and production requirements. If production methods will cut your costs, we can set your job up in our experimental processing department and you can inspect the machines in operation.***

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AMC
AUTOMATIC BUFFING MACHINES

# ACME *Manufacturing Co.*

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*Builders* OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 35 YEARS



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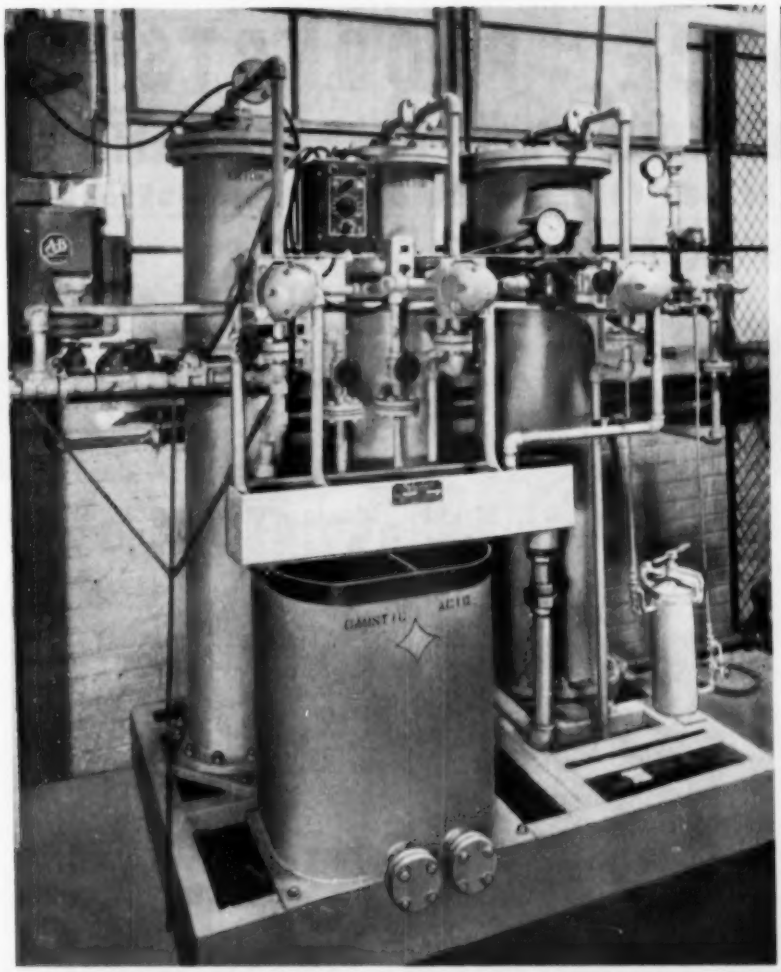


# treating plating rinse wastes at

## Sunbeam CORPORATION

CHICAGO 50, ILLINOIS

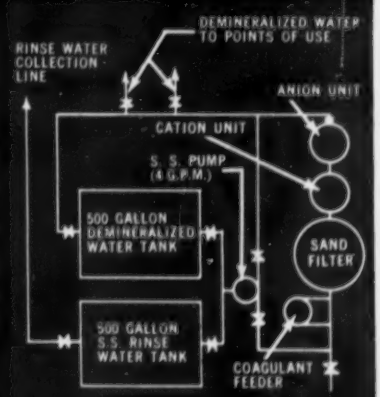
*INDUSTRIAL waste treating unit consisting of rubber-lined sand filter with coagulant feeder, cation and anion exchangers complete with pumps, used for treating plating rinse water to remove gold and nickel salts, remove sulfuric and boric acids and return demineralized water to the recirculating system.*

## *Industrial* tailored treating units pay for themselves

INDUSTRIAL units for the treatment of metal finishing wastes are used for the recovery of precious metals and for supplying demineralized water for stainless rinsing. The value of the recovered metals, reuse of demineralized water in the recirculating system, and the elimination of troublesome contaminants all add up to pay for the installation, frequently within a matter of months.

Complete INDUSTRIAL Systems are individually engineered and built to meet specific waste treatment problems. Write for full particulars and recommendations.

5453




Flow diagram of the INDUSTRIAL System for the demineralization of recirculated rinse water.

## INDUSTRIAL FILTER & PUMP MFG. CO.

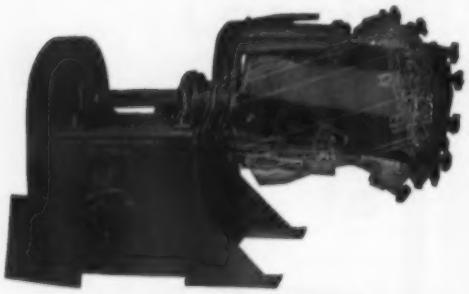
PRESSURE FILTERS
ION EXCHANGERS
RUBBER LININGS
HEAT EXCHANGERS
CENTRIFUGAL PUMPS

# USE "RELIANCE" PRODUCTS FOR

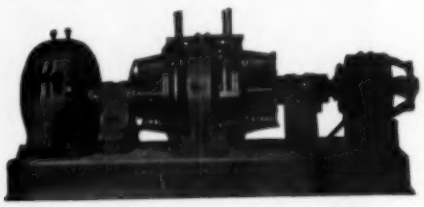
## ECONOMY : EFFICIENCY : DEPENDABILITY

**LET US SUPPLY YOUR NEEDS FOR YOUR PLATING OR POLISHING DEPARTMENT**

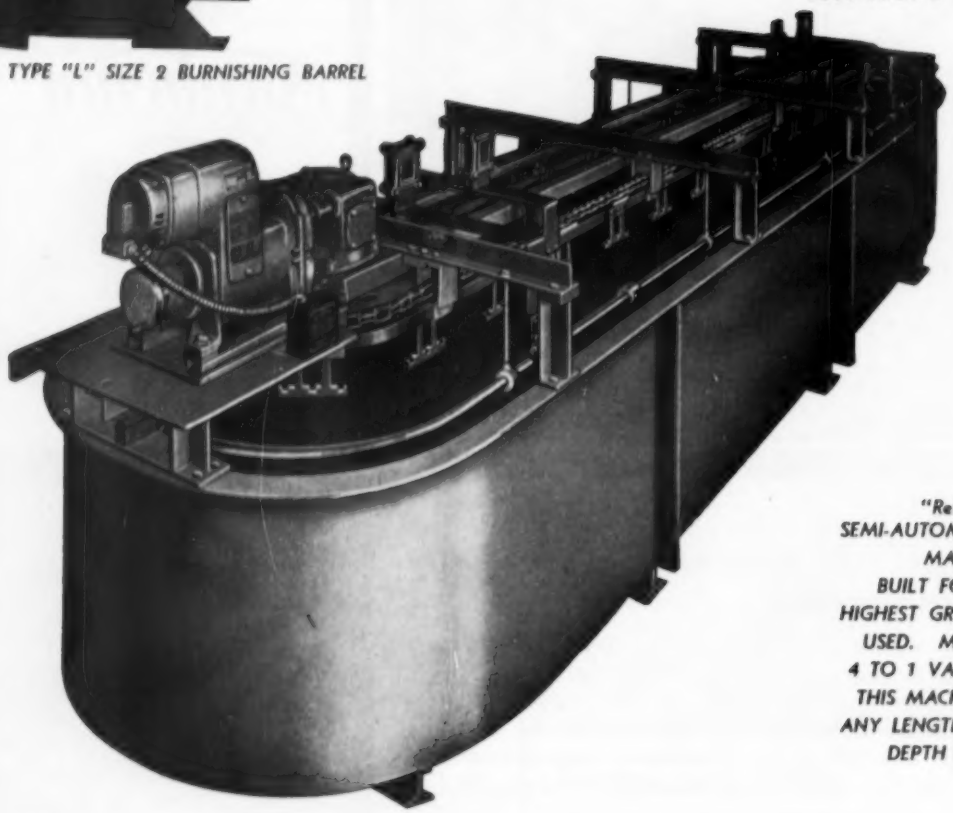
*WRITE FOR FURTHER DETAILS*



TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



"Reliance"
SEMI-AUTOMATIC PLATING MACHINE
BUILT FOR SERVICE
HIGHEST GRADE MATERIAL USED. MOTOR ½ HP
4 TO 1 VARIABLE SPEED.
THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

# Chas. F. L'Hommedieu & Sons Co.

**MANUFACTURERS of**

**Plating and Polishing Machinery**

***Complete Plating Plants Furnished***

Chas. B. Little Co.
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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 250.

INDUSTRIAL **Plating Facts** DECORATIVE

PUBLISHED IN THE INTEREST OF PLATING PROGRESS

# GERMANIUM RECTIFIERS ARE ANSWER TO LOW COST, LIFETIME EFFICIENCY

## SEL-REX First To Utilize Sealed Germanium Cells To Provide Superior Plating Power

BELLEVILLE, N. J. — The development laboratories of Bart-Messing Corporation, famous in the plating industry as pioneers in modern plating techniques and equipment, again pace the industry with the development of SEL-REX GERMANIUM POWER RECTIFIERS.

## UNLIMITED LIFE

### *Completely Sealed Germanium Cells Impervious To Aging*

Because Germanium cells do not age they continue to supply the initial high efficiency after years and years of service. Germanium rectifiers operate in high ambient temperatures (55° C.) without overheating.

## *REDUCED SIZE AND WEIGHT*

Diminutive size of Germanium cells permits tremendous savings in weight and size of unit — *more power in less space.*

## PHENOMENAL EFFICIENCY

With operating efficiency up to 92%, SEL-REX GERMANIUM POWER RECTIFIERS are undoubtedly *the most efficient D.C. power conversion equipment built.* This high overall operating efficiency is reflected in tremendous savings in operating costs when compared with all other conventional types of equipment. Germanium Rectifiers also have improved inherent output voltage regulation.

## *Now Available In Models From 500 To 50,000 Amps Output*

Bart-Messing Corporation is now offering to the plating industry a diversified line of SEL-REX Germanium Rectifier equipment in standard models from 500 to 50,000 amperes output. Equipment is available in conventional forced air cooled or completely sealed water cooled design.

## MAGNETIC AMPLIFIER CONTROL

Sel-Rex Germanium Rectifiers are also supplied with static magnetic amplifier control for automatic regulated output units.

*Write at once for complete information or quotation.*

**BART-MESSING CORPORATION**

**229 Main Street — Belleville 9, N. J.**

***Manufacturers and Distributors of Plating Supplies and Equipment***

# NOW THE NUMBER OF RICHARDSON-ALLEN SELENIUM RECTIFIERS *in use by this company* HAS REACHED 100

## *Performance Did It!*

So great was the satisfaction given by the initial installation of 22 R-A Selenium Rectifiers in The Perfect Circle Corporation's plants in Hagerstown and Richmond, Indiana, and in Toronto, Canada, that today the number in their plants totals 100!

These units, rated mostly at 12 volts, 1500 amperes, are of special design needed for that fine uniformity of chromium plate which is a "must" in all Perfect Circle Piston Rings.

The rapid spread of R-A installations throughout industry is due to just this kind of performance!

*Courtesy of The Perfect Circle Corporation*

## ADVANTAGES OF RICHARDSON-ALLEN SELENIUM RECTIFIERS IN THE PLATING INDUSTRY

- Marked increase in production
- Notably improved plating quality
- Full power at once; no warm-up
- Reduction in number of rejects
- No moving parts except cooling fans
- Practically no maintenance expense
- Capacities from 250 to 12,000 amperes in single packages
- Special switches or controls for chrome, bright nickel, gold, silver, anodizing
- The ideal rectifier supply for anodizing
- "Heat Exchanger" available for operation in corrosive atmospheres

**RICHARDSON-ALLEN CORPORATION**

***a manufacturing affiliate of***

**WESLEY BLOCK AND COMPANY**

**39-15 MAIN STREET, FLUSHING, NEW YORK**

**IN CANADA: Richardson-Allen of Canada, Ltd., 370 Victoria St., Toronto, Ontario**

**DEPENDABLE POWER FOR EVERY DC NEED**



**FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 252.**

# this is it!

## THE NO. 1 GREASELESS COMPOSITION

for

**POLISHING**

**BUFFING**

**BURRING**

**SATIN FINISHING**

## TOP QUALITY ABRASIVES • GLUES • BLENDING

For thirty years LEA has been THE NAME in the field of clean, efficient and economical finishing of metals, plastics and wood, with LEA COMPOUND leading the way . . . all the way. No products are superior to LEA products *anywhere* because they're developed by Specialists in Finishing and the best materials are used. The LEA laboratory offers careful analysis of your finishing problem and the RIGHT solution to it.

*There's a Lea* **COMPOSITION** *for* **EVERY** *surface finishing job.*
*Just write us about yours.*

**Yes, Lea Compound leads the way with some other well-known LEA PRODUCTS serving industry everywhere such as LEAROK • LEA LIQUABRADE • AD-LEA-SIVE • LEABRAMENT LEA SPRAY GUN MOVER • LEA LIQUALUBE • cLEAn GRAIN LUBAR • LEA GRIPMASTER LEA LAPPING PASTE • LEA LUBAR**

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions.

Manufacturers of Lea Compound and Learock . . . Industry's quality buffing and polishing compounds for over 30 years.

## THE LEA MANUFACTURING CO.

**16 Cherry Ave., Waterbury 20, Conn.**

**LEA-MICHIGAN, INC.**
14066 Stansbury Avenue
Detroit 27, Michigan

**LEA MFG. COMPANY OF CANADA, LTD.**
370 Victoria Street
Toronto 2, Canada

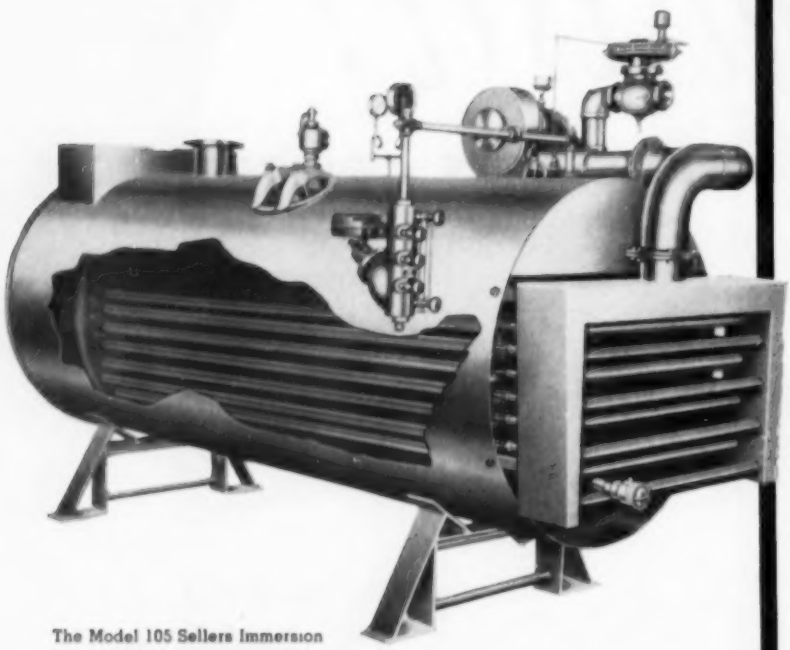
**LEA-RONAL, INC.**
42-48 27th St.
Long Island City, N. Y.

INDICATE A 253.

**Lea Gripmaster Polishing Wheel Cement, matching the high quality of other Lea Products, is now available through Lea-Michigan, Inc., 14066 Stansbury Ave., Detroit 27, Michigan.**

*There's a good reason why*

# SELLERS BURNS GAS "INSIDE THE WATER"



The Model 105 Sellers Immersion Steam Boiler is another steam boiler designed and built with totally submerged and horizontally located firing tubes.

This system of firing permits all gas to be burned inside the submerged tubes — and therefore *inside the water.*

Every tube is an individual combustion chamber with its own burner — *completely surrounded by water.* This is the most efficient method ever devised.

And this system permits "spreading out the fire" — to put every square foot of heating surface to work, increasing life, internal circulation, and operating efficiency.

The Sellers Model 105 Immersion Steam Boiler is only one of a complete line — all are companion boilers to the famous Sellers Model 46. Investigate this line — there is one to fit your requirements.

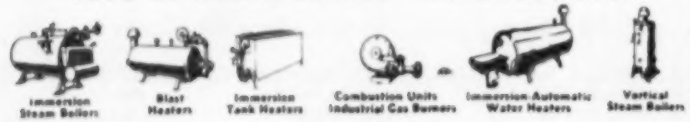
**BEFORE YOU BUY ANY STEAM BOILER, CONSIDER THESE FACTS**

- ***MINIMUM SCALE PROBLEM***
  Intermittent firing of the boiler brings about alternate expansion and contraction of the firing tubes which loosens scale which might form on the tubes. This scale drops to the bottom of the shell out of the firing zone and cannot bake on to the firing tubes. Clean out openings are provided.
- ***CONTINUED HIGH EFFICIENCY***
  As long as firing tubes are kept clean, original high efficiency is economically maintained.
- ***NO WATERLINE CORROSION***
  With all firing tubes totally submerged, there is no corrosion at the waterline—where tubes normally fail. In Sellers immersion type steam boilers, there can be no waterline corrosion.
- ***MORE EFFECTIVE INSULATION***
  More effective insulation is possible because the insulation is against heat loss from low temperature steam and water instead of a high temperature combustion chamber.
- ***FASTER STEAMING AND DRYER STEAM***
  Rapid steaming and dry steam takes place because of the large surface area of the water. All surface water is heated first since the firing tubes are located close to the water line.

Sellers

**ENGINEERING COMPANY**

4876 N. CLARK STREET CHICAGO, ILL.




***Save Dollars Now!***

**SELLERS ENGINEERING COMPANY**
**4876 N. Clark Street**
**Chicago, Illinois**

☐ Please send us complete information on the Sellers 105 Model Steam Boiler.
☐ Send us the Tell-All folder on the Sellers complete line of steam boilers.

Name_____

Company_____

Address_____

City_____ State_____

Dept._____

# Cleaning Specialists*

*[SPE'CIAL·IST—One who devotes himself to some special branch of activity.]

At Northwest our "special branch of activity" is solving your cleaning problems.

Behind your friendly, competent Northwest Sales Engineer stands a reputation for providing industry with low-cost, analytically-correct, job-adjusted chemical cleaners.

From Northwest's years of experience in formulating the RIGHT cleaner for your specific needs have come such developments as the LO-HI pH PROCESS—for cleaning prior to plating, painting, or vitreous enameling; ALKALUME PROCESS—for preparing aluminum and magnesium for finishing and spot welding; INTERLOX PROCESS—for phosphate coating; SPRA-LUBE—to control over-spray of "today's" paints in water wash paint booths; PAINT STRIPPERS—specific to your needs; SUPER-DRAW & FLUID FILM—for drawing metals.

**Remember—YOUR COST PER FINISHED ARTICLE IS THE TRUE COST OF YOUR CLEANER.**

Northwest's production-tested chemicals and "Right the first time" recommendations will save you money. Northwest Service is as close as your phone.

LO-HI pH

NORTHWEST CHEMICAL CO.

9310 ROSELAWN DETROIT 4, MICH.

pioneers in pH cleaning control ... serving you since '32

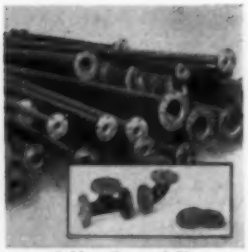


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 255.

● To electroplaters and plating department heads in every section of the nation, the name ARco is symbolic of broad engineering knowledge . . . advanced methods and equipment . . . bringing top plating results.

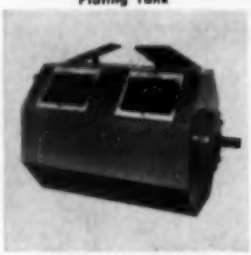
Corrosion-resistant ARco rubber coverings are applied to tanks and accessories, Diaphragm Systems, Parts Separators, Air Agitation Systems, Grids and Screens, Ventilation Equipment, Pipes and Fittings, Materials Handling Equipment. For expert advice on economical, efficient rubber applications to electroplating equipment, call on ARco engineers. Their help is offered to you without obligation.

Sheet Rubber Lined Plating Tank—Open Type


Rubber Covered Pipe and Fittings

Rubber Lined Diaphragm Plating Tank

ARco Rubber Lined "Handy-Tanks"


ARco Rubber Insulated Tumbling Barrel

Seamless Rubber Insulated Handling Equipment

# ARco Materials, Equipment, Engineering and Service . . . Vital To Better Electroplating

## . . . assure improved plating quality and production!

LEARN ABOUT ARco DIAPHRAGM SYSTEMS—INDUSTRY'S OUTSTANDING ELECTROPLATING METHOD!
Clip the coupon below—fill it in now and get this, valuable information . . . yours without cost!
ARco

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12574 Beech Road at P. M. R. R.
Detroit 39, Michigan

Please rush me_____copies of your "Diaphragm Tanks Promote Plating Progress."

☐ Have your representative call on us.

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**ARco FIELD SERVICE UNITS**

ARco Field Service Engineers bring complete technical know-how and facilities right into your plant. Permanent installations or equipment too large to move can be fabricated and covered right on the job by our Field Service Units.

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Anything can be covered with rubber—by ARco

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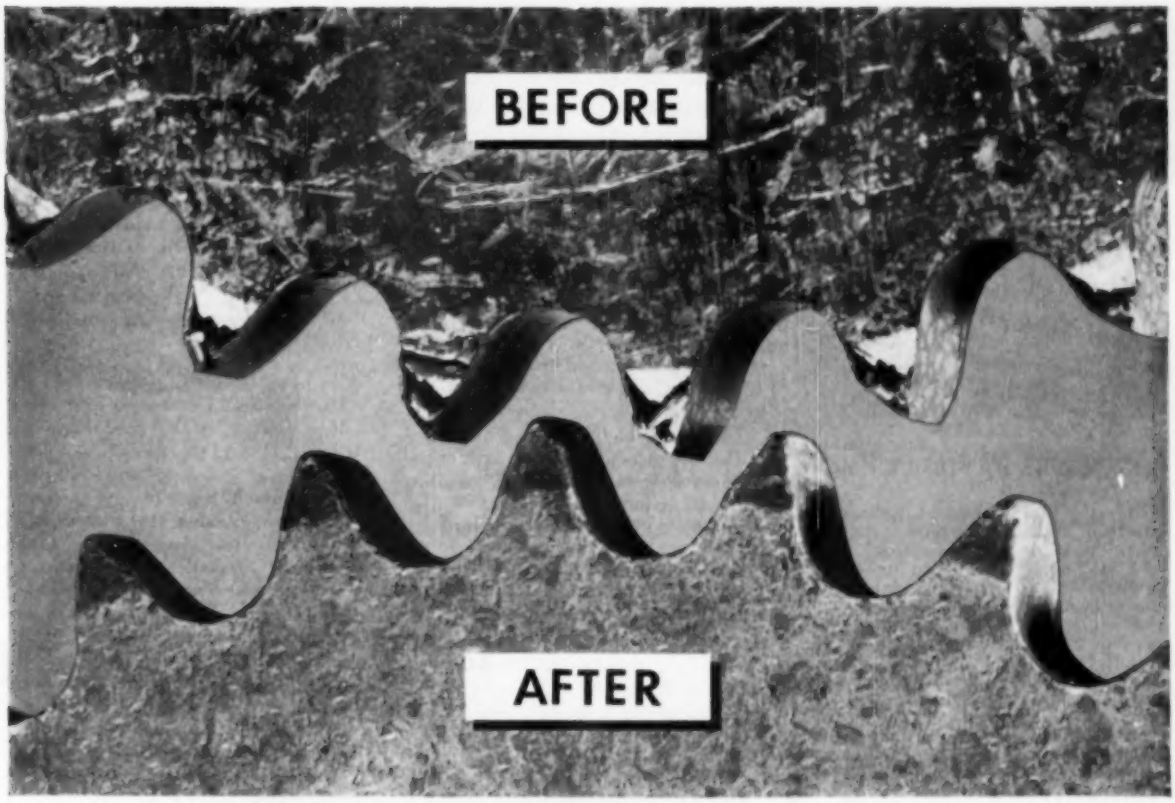
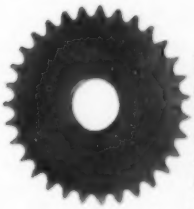



**BEFORE AND AFTER** *photos show how the HONITE Method finishes steel roller chain sprockets. Note how smoothly and evenly the stubborn hobbing burrs have been removed.*

***Milwaukee manufacturer finds . . .***

# HONITE BARREL FINISHING CUTS COSTS 60%



The Chain Belt Co., of Milwaukee, Wisconsin, makes 7½" diameter steel sprockets for roller chains in large quantities. On this unit the company cut two finishing steps to only one . . . cut finishing costs from 6½¢ per unit to 2½¢ . . . cut unit finishing time by 35% . . . when they switched to the Honite Barrel Finishing Method.

Here's how. The company formerly used grinding and hand-filing methods to remove hobbing burrs and de-scale and de-grease sprockets. Now, with the recommended Honite Method, these steps are performed simultaneously. And with a more uniform finish, parts are cleaner; burrs and scales are eliminated completely.

Find out today how Honite Barrel Finishing Methods can increase production, cut unit costs, give better, more uniform finishes faster. You'll be money ahead if you put the Honite Method to work in your plant. Call your Honite Methods Engineer or nearby Honite Distributor for complete facts.

Honite BRAND

MINNESOTA MINING AND MFG. CO.
Dept. P-25, St. Paul 6, Minn.

☐ Send me FREE "Facts and Figures Report on HONITE Barrel Finishing"

☐ I'd like to talk with a HONITE Methods Engineer

Name.....Title.....

Company.....

Address.....

City.....Zone...State.....

Type of products to be finished.....

Made in U.S.A. by Minnesota Mining and Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: P. O. Box 757, London, Ont., Can. Export: 99 Park Ave., New York City. Makers of "Scotch" Pressure-Sensitive Tapes, "Scotch" Brand Magnetic Tape, "3M" Adhesives, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing.

3M COMPANY

## Polyesters by Prescription

**NOW . . .** The Chemical Corporation research and development program makes possible a "prescription" type of PLA-TANK formulation for *specific problems.* It is literally possible for our technical service engineers to prescribe one of a number of vastly improved combinations of PLA-TANK material for liquid contact applications never before considered suitable for ordinary polyester plastics.

For example, tests prove that all *new* PLA-TANK electro-platers' tanks now offer far better performance on hot sulphuric, nitric, phosphoric and chromic acid solutions than any other commercially available fiber glass tank.

## Remember — All Polyesters are not Alike

**PLA-TANK** achieves these vastly improved resistances by carefully controlled variations in either the resin or fiber or both. Now more than ever "*all polyesters are not alike*" and COMMONLY PUBLISHED STUDIES OF POLYESTER PERFORMANCE MUST NOT BE APPLIED TO PLA-TANK SPECIAL MATERIALS.

Intensive research and testing covering thousands of samples have isolated and selected those alkyds which show highest chemical resistance to various specific agents and matched them with the most effective cross links.

NOW . . . you can "prescribe" new PLA-TANK for your own *specific* needs, knowing your tanks will have increased usefulness and longer life.

**Benefit from continuous research and development with PLA-TANK — first in the field, and still the leader.**

***WRITE TODAY — mentioning your requirements, for complete data sheets on new PLA-TANK material.*** P-18

THE *Chemical* CORPORATION
57 Waltham Ave., Springfield 9, Mass.

# *Branch News*

(*Continued from page 172*)

**Robert Sizelove,** General Sales Manager; **Ed Hollister,** representing the Eastern territory; and **Emil Pieper,** Ray's successor. Also attending were **Henry Holbert,** Easy Washing Machine Company of Syracuse; and **Robert Hilgenberg,** Oneida, Ltd., Canastota.

Ray came to Rochester from the New England area and went to work for Lustre Chemical Company, and was later employed by the Scobell Chemical Company. He left to go to Gumm 16 years ago.

After the award was made, Ray was presented a clock radio from the branch.

The success of the party is attributed to the good planning and hard work of the committee members, **Cecil Thornton, John Hourihan,** and **Richard Waite.**

FREDERICK L. JOHNSON, Secretary

### ROCKFORD

The regular monthly meeting of the Rockford branch was held December 13 at the Faust Hotel with 20 members in attendance. Secretary **E. Budden** reported that plans for the annual educational session and banquet to be held March 19 at the Faust Hotel were well underway.

Three new members elected to membership were: **D. Haskins,** American Machine and Metals; **R. Hood,** Turco Products; and **H. Ellis,** Commercial Wire Products.

The speaker for the evening was **R. Scott Modjeska,** who presented the paper he gave at the national convention in New York.

E. J. BUDDEN, *Secretary*

### ST. JOSEPH VALLEY

The regular monthly meeting of the St. Joseph Valley branch was held at the Hotel Elkhart, Elkhart, Ind., on January 5. Forty-one members and guests attended the technical session.

**Kenneth Mitchell** was elected to active membership. The application for membership of **Donald C. Mayer,** of Universal Tool & Stamp, Ft. Wayne, was read. **Duke Wysong** advised the members of a research project by the ASTM on plating of cast iron and gray iron and requested information relative to methods, procedures and solutions to be transmitted to this research committee.

**Leonard Weeg,** former officer of the St. Joseph branch, now of Rockford, Ill., renewed old acquaintances with his many friends.

President **John Bayman** turned the meeting over to Librarian **Don Kraft** who introduced the guest speaker, **Gene Gwyer** of Hanson Van-Winkle-Munning, in charge of equipment sales at the Detroit office. Gwyer spoke on automatic plating equipment. With the help of slides, he illustrated the variety of work and the flexibility of automatic equipment for all plating. A film of an automatic plating conveyor at the National Lock Company, of Rockford, further illustrated the possibilities of this type of equipment.

Gwyer answered many questions from members during the showing of the slides and film and after the talk. Leonard Weeg assisted on actual operational problem questions since the moving pictures were taken in his plant on his equipment.

EUGENE ROTH,
*Secretary-Treasurer*

### SOUTHERN TIER

The Southern Tier branch of the AES held a meeting at the Iron Kettle Inn, Waverly, N. Y., December 21, 1954. The meeting was called to order by vice-president **Rood.**

**Stefanski** introduced the guest speaker, **Ken Bellinger,** vice-president of the Chemical Corporation, who spoke on polyesters as used in plating. Polyester, one of the newest groups of plastics, became known at the tail end of World War II.

The possibilities of using polyesters were discovered by a bright dip solution leaking into a tote box made from a polyester resin. Polyesters are extensively used for duct work, troughs and low pressure piping.

An interesting color film was shown titled, "Polyesters to Prescription."

Bellinger answered many questions after the movie.

T. MAXIAN, *Secretary*

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### PLATING Appoints New Production Manager

James C. Adams became the new Production Manager of PLATING on January 10.

The 36-year-old veteran of the magazine field has been actively engaged in all phases of publication work and more recently maintained his own firm in New York. His more than 10 years of experience also includes editorial know-how.

Adams resides in Atlantic Highlands, New Jersey, is married and has three boys. During World War II he was First Lieutenant assigned to the Public Relations Office, Headquarters, European Theater of Operations.

Members of the PLATING staff are happy to have him "aboard." He succeeds Miss Mary K. Dickinson who for over five years directed production office activities in Philadelphia. Miss Dickinson, a resident of Camden, New Jersey, resigned to accept a position with a Philadelphia publishing firm when the PLATING production office was moved to Newark, New Jersey.

# *Classified Advertisements*

Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.20 per word, minimum $5.00. AES branch members and members-at-large, in good standing, are entitled to a total of three *free* advertisements in one year. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J

WANTED—Young aggressive electroplating sales engineer to handle plating equipment, supplies and processes of well known manufacturers. Chicago area. Salary and/or commission open. Give education and experience record. Replies will be held confidential. Reply to: P-255-C, PLATING, 445 Broad St., Newark 2, N. J.

WANTED—Man for Research and Development department of New England company manufacturing metal finishing products with national distribution. Must have broad experience in metal finishing and plating and be willing to travel and lecture. Ultimate position to be Director of Research and Development. In reply give full details on technical background, experience, previous employment and salary requirements. All replies will be held confidential. Reply to: P-255-A, PLATING, 445 Broad St., Newark 2, N. J.

CHEMIST or CHEMICAL ENGINEER. Recent graduate, or experienced in metal finishing chemistry. Write immediately for interview. Detroit area. Reply to: P-255-B, PLATING, 445 Broad St., Newark 2, N. J.


**BRASS PLATING WITH TRUE BRITE**

❶ improve color

❷ save labor

❸ eliminate supervision

❶ *color stays constant . . . no rejects*

❷ *eliminates frequent analyses . . .*

❸ *trouble free . . . only one addition instead of three*

*Write for FREE bulletin! Your key to better Brass Plating*

Available in regular 3 to 1 ratio for yellow Brass Plating.

Special ratio materials for plating richlow brass or any other desired alloy of copper and zinc.

Suitable for both still tanks and barrels.

**TRUE BRITE CHEMICAL PRODUCTS CO.**

P. O. Box 31, Oakville, Conn.



**Available for Immediate Shipment, Attractive Values**

**THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:**

**PLATERS**

1—7500/3750 AMPERE, 9/18 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous.
1—5000/2500 AMPERE, 9/18 VOLT, **COLUMBIA.**
1—5000/2500 AMPERE, 8/16 VOLT, **CHANDEYSSON,** 25° C., Exciter-in-head.
1—5000/2500 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Synchronous, Exciter-in-head.
1—4000/2000 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **COLUMBIA,** Synchronous.
1—2500/1250 AMPERE, 9/18 VOLT, **ELECTRIC PRODUCTS,** Synchronous, Exciter-in-head.
1—2000/1000 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS.**
1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous, Exciter-in-head.
1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—1000/500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS.**

**ANODIZERS**

1—4000 AMPERE, 40 VOLT, **CHANDEYSSON,** Exciter-in-head.
1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25° C.
1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.
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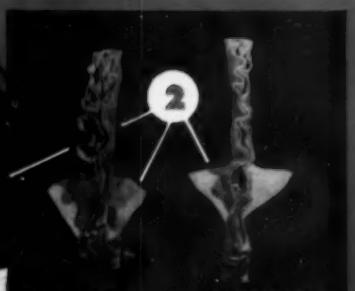

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This book is believed to be the only comprehensive single volume dealing with the brittle behavior of metals at low temperatures. It will be useful to designers, engineers, and metallurgists in practically all branches of engineering in making them more fully cognizant of the joint role played by metallurgical and mechanical factors and their influence on the behavior of metals at low temperatures. It will be of particular value to fabricators of chemical equipment to be operated at low temperatures; fabricators or operators of pipelines for transmission of natural gas; fabricators of large welded structures such as bridges, storage tanks, or ships, steel companies engaged in the production of steel; and foundries producing castings for refrigerators and equipment operated at low temperatures. Teachers of college courses in these fields will find it a valuable supplementary text or reference book.

Volume VIII in the **Organic Reactions** series—Roger Adams, editor-in-chief. 437 pages. John Wiley and Sons. $12.00 to nonmembers; $10.30 to members.

In accordance with the established procedure of the series, the new volume goes exhaustively into a select set of reactions or a definite phase of a reaction, each examined from the preparative viewpoint, and with special attention given to limitations, interfering influences, effects of structure, and the selection of experimental techniques. The eight reactions that now join the growing group are studied by the authorities who work most closely with them and have been selected on the basis of their wide applicability and value to current research.

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**Adhesion and Adhesives—Fundamentals and Practice.** 229 pages. John Wiley and Sons. $9.75 to nonmembers; $8.30 to members.

This book contains a collection of the papers read at two conferences that were held simultaneously at the Case Institute of Technology and in London. At these symposia, the motivating factors were the rapid expansion of high polymers in industrial use, and the increasing appearance on the market of more versatile adhesives for use in structures and protective contings.

Edited by F. Clark of the Society of Chemical Industry in London, and John E. Rutzler and Robert Savage, both of the Case Institute of Technology, the new book brings together the research material of 53 specialists who met at the conferences. Discussions in theoretical fundamentals cover such topics as joint strength, solid-solid interfaces, fluids, and molecular and intermolecular forces. In the papers dealing with practice, the authors cover the use of adhesives in glass, paper, wood, roads, films, aircraft, plastics, metals, rubber, and textiles, among other related details.

**Statistical Analysis in Chemistry and the Chemical Industry** by Carl A. Bennett and Norman L. Franklin, 1954, xvi + 724 pages. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price, $8.00.

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(*Continued on page 194*)

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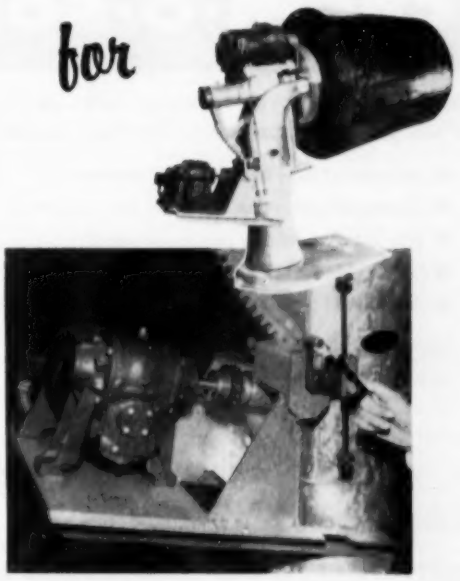

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## Books

methods which are likely to find use in the chemical and allied industries, and sufficient statistical mathematics for an adequate background is happily combined with well presented examples of practical applications.

The book is magnificently written, and those who want quick proof of this statement are referred to pages 538 to 580. Here the reader will find an unusually clear presentation on the principles of experimental design by the method known as confounding. This technique offers increasing possibilities in the field of electrochemical research, particularly electroplating, and it is a pity that others have not utilized it as fruitfully as the agricultural chemists.

The text is so closely integrated and interwoven that it is not suitable for casual reference and its full value can only be realized by full and careful reading. This is by no means a limitation; it is, rather, a tribute to the high order of organization which the authors have achieved.


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## Part I of AES Project No. 14

EDITOR'S NOTE: *Due to the length of this report, it has been broken down into three parts. The second part will appear in the March issue, and the third will appear in April.*

### Acknowledgment

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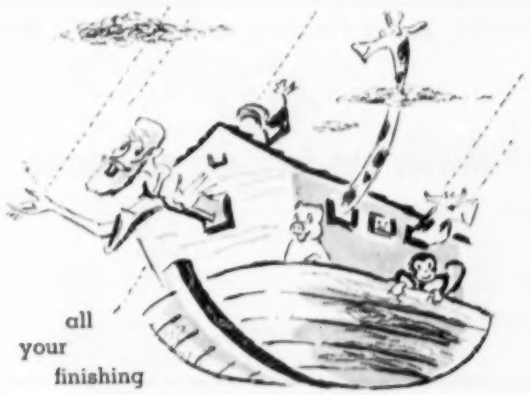

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(*Continued on page 208*)


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# AES News

### National Technical Task Committee on Industrial Wastes

Following close upon the heels of the Michigan Water Resources Conference, the National Technical Task Committee on Industrial Wastes convened at Michigan State College for a two-day meeting. This Committee is made up of technologists drawn from every industry creating liquid wastes as by-products of manufacturing operations. Formed by invitation of the Surgeon General of the United States Public Health Service, this group meets annually to discuss progress in water pollution abatement.

Milton P. Adams, Executive Secretary of the Michigan Water Resources Commission, addressed a dinner meeting of the Committee. Mr. Adams said, "Conservation of water is becoming increasingly important in the economy of Michigan. This means that water used in manufacturing operations must be suitably treated before discharge to streams so that our rivers will remain healthy and their waters will be in good condition for downstream users. It is our desire to cooperate fully with all industry, but especially with companies planning to locate in Michigan, by advising them on the kind and degree of treatment their wastes will require." The enlightened attitude of the Water Resources Commission toward water pollution abatement was commended by the Committee.

Mr. Howard Prentice, a member of the Committee, said, "Our rapidly growing population and our steady increase in living standards contribute to the complexity of the water pollution abatement problem. We must meet this challenge with more scientific research to provide better means for decently disposing of waste water."

Manufacturing processes are grouped in four categories, each with its own Task Committee. In the reports these Subcommittees made during the meeting it was repeatedly emphasized that the growing seriousness of water shortages, particularly in the southwestern part of the country, has made it necessary to reuse water formerly discarded as waste. The practice of reusing water in the mining industry has materially reduced pollution from that source. The Subcommittees also reported advances in pollution abatement by reducing in-process waste, by substitution of raw materials with a low pollution potential for compounds difficult or impossible to treat, and by changing or eliminating processes responsible for serious pollution. One solution to the problem of water shortages is the use of waste water from the food-processing industry for irrigation.

Every segment of industry reported substantial progress in water pollution abatement during 1954. Many difficult problems remain unsolved, however, and the necessity for a much greater amount of fundamental research was stressed. The Committee voiced its appreciation of the research being carried out at the Robert A. Taft Sanitary Engineering Center of the Public Health Service at Cincinnati. Individual companies and industrial trade associations were praised for their support of scientific research on industrial wastes. The conference ended on the optimistic note that even greater accomplishments may be expected in 1955.


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**SERVICE** . . . Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.
**DESIGN** . . . **Filter Assembly** fabricated of stainless steel 316, high temperature lucite, rubber-lined, Haveg or Sethrin* resin. **Filter Tubes** of cotton, dynel, porous stone or porous carbon. **Pumps** fabricated of Hastelloy, stainless 316 or plastic; centrifugal or self-priming. **Motors** drip-proof, totally enclosed, or explosion proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. **Hose** — special acid and alkali resistant. **Base** — Linen Phenolic laminate on rubber tire ball bearing casters.

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## AES News

### Rochester Branch, RIT Offer Course

Electroplating I is a lecture and discussion course. Its purpose is to present and analyze the principles of chemistry and electricity involved in electroplating. The specific topics included are: nature of matter; chemical reactions; technical calculations; electronic nature of matter; electrochemistry; theory of plating; preparation for plating; plating; miscellaneous; and control.

This course is being offered in cooperation with the Rochester branch, AES, Educational Committee.

This course is designed to meet the needs of electroplaters and others who need a technical understanding of this work.

The instructor is Walter Swanton, M.S. in Chemical Engineering, Engineer at the Pfaudler Co.

### NTTCIW Elects 1955 Officers

The National Technic Task Committee on Industrial Wastes elected K. S. Watson chairman for 1955. Watson is a consultant on water management and waste control to the General Electric Company, Schenectady, N. Y.

The AES was represented by Dr. C. F. Gurnham of Michigan State College and Dr. D. G. Foulke as alternate. Dr. Gurnham was elected vice-chairman. L. F. Warrick of the Public Health Service was re-elected secretary. Warrick has served as secretary to the Committee since its organization in May, 1950.

### Obituary

An announcement of the passing of one of the oldtimers on December 4th, after a prolonged illness, was cause for sadness for Ralph Leonard Shannon who was born February 5, 1896. He was for many years an active member of the Chicago branch. He was associated with the Diversey Corp., from October 18, 1943 until his death. Since October 1, 1949 he had served as Promotional Manager of their metal industries department. During World War I he served in the Air Corps. He is survived by his wife, two married daughters and seven grandchildren.

**Branch Subscribers to AES Research Fund**
(In addition to per capita tax remittances)

**St. Louis** . . . . . $100.00

The above Branch should be commended for doing something "extra" for AES Research.

### NYSSPE's Testimonial Dinner

The five New York City Chapters of the NYSSPE are tendering a testimonial dinner to the Polytechnic Institute of Brooklyn in celebration of its centennial. The dinner will be held on February 24, 1955, at the Hotel St. George, Brooklyn, N. Y. The Kings County Chapter is heading up all arrangements for this affair.

"Brooklyn Poly" is one of the oldest engineering schools in the United States and the Alma Mater of many members of engineering societies. Many colleges, universities, learned societies and foundations propose to participate in this celebration.

An outstanding program comprising speakers of national reputation and adequate radio and TV coverage is being arranged.


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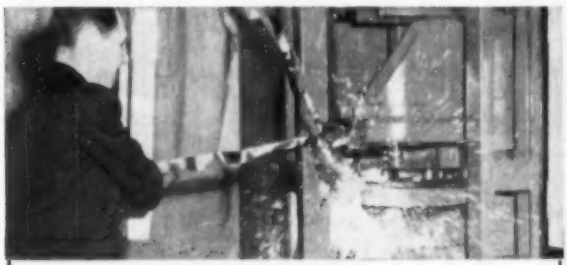
A new X-ray microscope is able to magnify details of internal structures of metals and small objects as much as 500 diameters with adequate sharpness.

* * *

A silicon wafer with a boron coating a tenth of a mil thick is the key element in a battery that will turn sunlight directly into electricity at six per cent efficiency.



The christening! The *Stevadoer*, the newest addition to the complete Stevens line of automatic plating and processing equipment, will be announced soon. Write us so that your name can be placed on our announcement mailing. *Frederic B. Stevens, Inc., Detroit 16, Michigan.*

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   - A. Hot soak cleaner 220/3/60
   - B. Cold Water Rinse
   - C. Acid Dip
   - D. Acid Rinse
   - E. Double plating tank lined
   - F. Cold water rinse
   - G. Hot water
   - H. Loading and unloading stand
   - I. 4—12 x 42 Melamine Cylinders (for straightline plating)
2. **Lesalco No. 3 Bumishing Barrels**
3. **Baird No. 1, No. 2 double and single, ball bumishers**
4. **U. S. Electric Double 15 H.P. Polishing Lathes 220/440 volt, 3 phase, 60 cycle**
5. **Chas. L'Hommedieu 5 H.P. Variable Speed Lathes 1500–3000 RPM, 220 volt, 3 phase, 60 cycle**

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Such notification should be made to headquarters by letter, post card, or post office form No. 22S, giving the old address as well as the new, with postal-zone number if any. You should also notify your local post office on postal form No. 22 of your change of address. Both postal forms are obtainable at any post office.

As considerable time is required to process a change of address, you are urged to advise the PLATING Circulation Department as soon as you know your new address, preferably three weeks in advance of moving.

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# Future Meetings

AMERICAN SOCIETY FOR TESTING MATERIALS, 1955 COMMITTEE WEEK, Cincinnati, Ohio, January 31–February 4, 1955.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERING, annual meeting, Chicago, Illinois, February 13–17, 1955.

AIME, annual meeting, Conrad-Hilton, Chicago, Illinois, February 14–17, 1955.

DAYTON BRANCH, AES, annual meeting, Hotel Biltmore, Dayton, Ohio, February 19, 1955.

GRAND RAPIDS BRANCH, AES, annual meeting, Pantlind Hotel, Grand Rapids, Michigan, February 19, 1955.

CAPITOL DISTRICT, AES, annual meeting, Menands, New York, March 7, 1955.

ELEVENTH ANNUAL CONFERENCE AND EXHIBITION of the National Association of Corrosion Engineers, Palmer House, Chicago, Illinois, March 7–11, 1955.

WATERBURY BRANCH, AES, annual meeting, Hotel Elton, Waterbury, Connecticut, March 10, 1955.

BALTIMORE-WASHINGTON BRANCH, AES, annual meeting, Washington, D. C., March 12, 1955.

AMERICAN SOCIETY OF TOOL ENGINEERS, WESTERN INDUSTRIAL EXPOSITION, Shrine Auditorium and Shrine Exposition Hall, Los Angeles, California, March 14–18, 1955.

AIME, Connecticut Local Section, annual meeting, Statler Hotel, Hartford, Connecticut, March 16, 1955.

LOUISVILLE BRANCH, AES, annual meeting, Louisville, Kentucky, March 17, 1955.

ROCKFORD BRANCH, AES, annual meeting, Faust Hotel, Rockford, Illinois, March 19, 1955.

SECOND ANNUAL TRI-STATE NATIONAL MEETING, AES, Columbus, Ohio, March 26, 1955.

CINCINNATI BRANCH, AES, annual meeting, Columbus, Ohio, March 26, 1955.

NINTH WESTERN METAL EXPOSITION, Pan-Pacific Auditorium, and Ninth Western Metal Congress, Ambassador Hotel, Los Angeles, California, March 28–April 1, 1955.

127TH MEETING, AMERICAN CHEMICAL SOCIETY, Cincinnati, Ohio, March 29–April 7, 1955.

TWIN CITY BRANCH, AES, annual meeting, The Covered Wagon, Minneapolis, Minnesota, April 4, 1955.

AMERICAN CHEMICAL SOCIETY, 127th meeting, Cincinnati, Ohio, March 29–April 7, 1955.

BRIDGEPORT BRANCH, AES, annual meeting, Hotel Barnum, March 29–April 7, 1955.

UPPER NEW YORK REGIONAL MEETING, AES, Hotel Seneca, Rochester, New York, April 16, 1955.

THIRD NATIONAL AIR POLLUTION SYMPOSIUM, Pasadena, California, April 16–19, 1955.

INDIANAPOLIS BRANCH, AES, annual meeting, Indianapolis Athletic Club, Indianapolis, Indiana, April 23, 1955.

BOSTON BRANCH, AES, annual technical session and banquet, Hotel Statler, April 30, 1955.

MILWAUKEE BRANCH, AES, annual meeting, Schroeder Hotel, Milwaukee, Minnesota, April 30, 1955.

TORONTO BRANCH, AES, annual meeting, Sherton-Brock Hotel, Niagara Falls, Ontario, May 7, 1955.

16TH ANNUAL NEW ENGLAND REGIONAL MEETING, AES, Hotel Statler, Hartford, Connecticut, May 14, 1955.

12ND ANNUAL AES CONVENTION AND 4TH INDUSTRIAL FINISHING EXPOSITION, Municipal Auditorium, Cleveland, Ohio, June 20–23, 1955.


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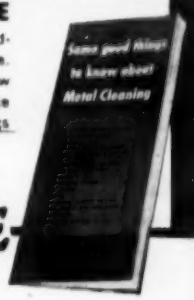


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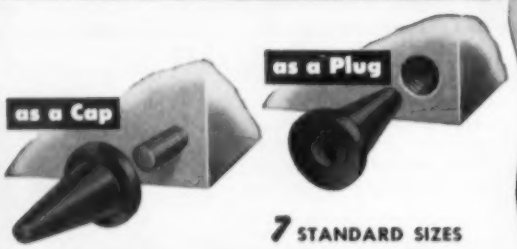


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**ADELAIDE** meets second Wednesday of each month. Secretary, R. J. Down, Room 30, 17 Currie Street, Adelaide, S. A., Australia.

**ALLENTOWN-READING** meets third Wednesday of each month in Scotty's Anchorage, Second and Main Streets, Emmaus, Pa. Secretary-treasurer, Edgar H. Iobst, Jr., 163 Main Street, Emmaus, Pa. Research finance committee chairman, Lee C. Wotring, 526 N. St. Elmo Street, Allentown, Pa.

**BALTIMORE-WASHINGTON** meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Carl H. Thiede, 8426 Piney Branch Road, Silver Springs, Md.

**BOSTON** meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass. Research finance committee chairman, Louis V. Gagnon, 53 High Street, Natick, Mass.


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## AES Directory

**BRIDGEPORT** meets second Friday of each month in Barnum Hotel. Secretary-treasurer, Robert G. Parker, 25 Beverly Road, Bridgeport 58, Conn.

**BUFFALO** meets first Friday of each month in Markeen Hotel. Secretary, Eric G. Sampson, Jr., 43 W. Main St., Falconer, N. Y. Research finance committee chairman, Donald Rice, 235 W. Delavan Avenue, Buffalo, N. Y.

**CAPITOL DISTRICT BRANCH** meets first Monday of each month at Panetta's Restaurant, Menanda, N. Y., at 7:00 P.M. for dinner, educational session at 8:00 P.M. Secretary, Paul D. Callahan, 1855 Becker Street, Schenectady 7, N. Y. Research Finance committee chairman, E. Raymond, P. O. Box No. 177, Cheshire, Mass.

**CENTRAL MICHIGAN** meets second Tuesday of each month alternating between Meadow Lark Inn in Jackson and Porter Hotel in Lansing. Secretary-treasurer, E. J. Bosca, 411 Third Street, Jackson, Mich. Research finance committee chairman, G. S. Woodruff, 2424 Dawn Avenue, Jackson, Mich.

**CHICAGO** meets second Friday of each month at 8 P.M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-treasurer, Paul Glab, 882 N. Paulina Street, Chicago 22, Ill. Research finance committee chairman, Charles Geldzahler, c/o Platers' Technical Service, Inc., 509 S. Wabash Avenue, Chicago 9, Ill.

**CINCINNATI** meets fourth Wednesday of each month at 6:30 P.M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary, L. J. Howald, 6265 Wiehe Road, Cincinnati 13, Ohio. Research finance committee chairman, C. R. Sorber, 2004 Connecticut Avenue, Cincinnati 24, Ohio.

**CLEVELAND** meets first Friday of each month in Hotel Carter at 8 P.M. Secretary-treasurer, A. J. Lupien, 4408 Carnegie Avenue, Cleveland 3, Ohio. Research finance committee chairman, to be appointed.

**COLUMBUS** meets first Friday of each month at 8 P.M. in Battelle Memorial Institute Auditorium. Secretary-treasurer, Michael Farr, 1735 Franklin Ave., Columbus 5, Ohio. Research finance committee chairman, to be appointed.

**DALLAS-FORT WORTH** meets third Wednesday of each month at 6:30 P.M. in Lennox Hotel, Grand Prairie, Texas half-way between Fort Worth and Dallas. Secretary-treasurer, research fund chairman, A. C. Fricke, 212 Julien Street, Dallas 3, Texas.

**DAYTON** meets third Wednesday of each month in the Biltmore. Secretary, Richard M. Clinebens, 33 W. Market St., Germantown, Ohio. Research finance committee chairman. Richard F. Moore, 526 Aberdeen Ave., Apt. B, Dayton 9, Ohio,

(*Continued on page 204*)

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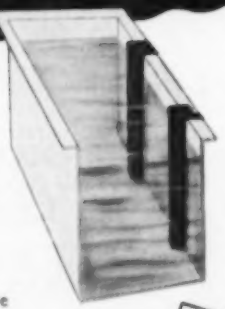

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## AES Directory

**DETROIT** meets first Friday of each month in Hotel Statler at 8 P.M. Secretary-treasurer, R. J. Racine, c/o Wyandotte Chemicals Corporation, Wyandotte, Mich. Research finance committee chairman, H. J. McAleer, 3171 Bellevue, Detroit 7, Mich.

**GRAND RAPIDS** meets second Friday of each month at Fingers Restaurant at 7 P.M. for dinner; educational session at 8:15 P.M. Secretary, John Dykstra, 104 Celia, S. E., Grand Rapids, Mich. Research finance committee chairman, R. O. Watson, 2206 Nelson S. E., Grand Rapids, Mich.

**HAMILTON** meets third Thursday of each month in the Conference Room, West End Plant, Canadian Westinghouse Company, Ltd. Secretary, R. Burke, c/o Swift Devices, 14 George Street, Hamilton, Ontario, Canada. Research finance committee chairman, W. G. Finlay, 7 Hill Street, Hamilton, Ontario, Canada.

**HARTFORD** meets third Monday of each month in Hotel Bond at 7:45 P.M. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research finance committee chairman, Frank Smith, Derby Milford Road, R. F. D. No. 1, Orange, Conn.

**HOUSTON** meets third Tuesday of each month at 7 P.M. in the Ben Milam Hotel, Houston, Texas. Secretary-treasurer, H. L. Mauzy, P. O. Box 2119, Houston 1, Texas.

**INDIANAPOLIS** meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Miss Edna Rohrabaugh, 816 Robert Street, Lafayette, Ind.

**JACKSON-LANSING:** Name has been changed. See Central Michigan.

**KANSAS CITY** meets fourth Thursday of each month at Roselli's Restaurant at 6:30 P.M. Secretary, Olin K. Bock, 5317 W. 58th Street, Mission, Kans.

**LANCASTER** meets second Friday of each month at 8 P.M. September, December, and April meetings are held at Hanover, York, and Harrisburg, respectively; all other meetings at the Old Mill Inn, Lancaster, Pa. Secretary-treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown, Pa. Research finance committee chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

**LOS ANGELES** meets second Wednesday of each month at 7 P.M. in Rodger Young Auditorium. Secretary, Norman K. McEwan, 17222 S. Arlington Avenue, Torrance, Calif. Research finance committee chairman, Tony Stabile, 417 E. 16th Street, Los Angeles 21, Calif.

**LOUISVILLE** meets third Thursday of each month in Kapfhammers Party House, 1506 S. Shelby Street, Louisville, Ky. Secretary-treasurer, Joseph G. Sterling, 1169 Keller Avenue, Louisville 13, Ky. Research finance committee chairman, R. G. Marshall, 3020 Talisman Road, Louisville 5, Ky.

## AES Directory

**MELBOURNE** meets third Thursday of each month at 8 P.M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary secretary-treasurer, R. W. Lennie, 433 Clarke St., Northcote, Melbourne 16, Australia.

**MILWAUKEE** meets first Friday of each month in the East Room, Hotel Ambassador. Secretary-treasurer, Clifford A. Peters, 3169 S. 47th Street, Milwaukee 15, Wis. Research finance committee chairman, T. Hartshorn, 4818 N. Woodruff Avenue, Milwaukee 11, Wis.

**MONTREAL** meets first Tuesday of each month in Mount Royal Hotel. Secretary, Jean Monette, 11700 Notre Dame Street East, Montreal, Canada. Research finance committee chairman, P. M. Condy, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, Canada.

**NEWARK** meets third Friday of each month at 8 P.M. in Hotel Robert Treat. Secretary-treasurer, George Wagner, Hy-Grade Electro Plating Company, 35 Fourth Street, Newark, N. J. Research finance committee chairman, John Gumm, 538 Forest Street, Kearny, N. J.

**NEW HAVEN** meets second Tuesday of each month at Mason Laboratory, Yale University. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Hamden 14, Conn. Research finance committee chairman, W. K. Murray, 48 Maple Avenue, Meridan, Conn.

**NEW YORK** meets second and fourth Fridays of each month in the Statler Hotel. Secretary-treasurer, George Schore, 833 Baldwin Drive, Westbury, L. I., N. Y. Research finance committee chairman, Milton Nadel, 41–15 50th Avenue, Long Island City 4, N. Y.

**PHILADELPHIA** meets fourth Friday of each month. Meetings are held at the Broadwood Hotel, Franklin Institute, or the Engineers' Club. Secretary, I. William Marcovitch, 1302 St. Vincent Street, Philadelphia 11, Pa. Research finance committee chairman, to be appointed.

**PITTSBURGH** meets first Wednesday of each month in the Avalon Room of the Sheraton Hotel. Secretary, Irvin H. Schram, Jr., 4782 Delma Drive, Pittsburgh 27, Pa. Research finance committee chairman, Myron Ceresa, 207 Highland Road, Pittsburgh 35, Pa.

**PORTLAND** meets second Tuesday at 5:30 P.M., in Waddles Restaurant. Secretary-treasurer, K. B. Humphrey, 2750 N. W. 31st Avenue, Portland 10, Ore.

**PROVIDENCE-ATTLEBORO** meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Secretary, Henry Shavier, 32 Hodges Avenue, Taunton, Mass. Research finance committee chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

**ROCHESTER** meets third Monday of each month at the 40 & 8 Club, 933 University Avenue. Secretary, Frederick Johnson, 21 Shire Oaks Drive, Pittsford, N. Y. Research finance committee chairman, Clarence VanEpps, 305 Hurstburne Road, Rochester 9, N. Y.

**ROCKFORD** meets second Monday of each month in Faust Hotel. Secretary-treasurer, E. J. Budden, 122 Twelfth Street, Rockford, Ill. Research finance committee chairman, David Stockton, 1511 Warren Road, Rockford, Ill.

**SAGINAW VALLEY** meets for dinner at 6:15 P.M. and for educational session at 8:00 P.M. at Zehnder's, Frankenmuth, Mich., second Wednesday of each month, September through May, except February. Secretary-treasurer, Dennis J. Goddeyne, 1300 N. McLellan Street, Bay City, Mich. Research finance committee chairman, A. J. Medwedeff, 2201 Bagley Street, Flint 4, Mich.

**ST. JOSEPH VALLEY** meets first Wednesday of each month at 8 P.M. in Elkhart Hotel, Elkhart, Ind. Secretary-treasurer, Eugene Roth, 739 N. College Street, South Bend 28, Ind. Research finance committee chairman, Adreiv Jurgensen, 119 James Street, Dowagiac, Mich.

**ST. LOUIS** meets second Wednesday of each month at the York Hotel, 6th and Market, St. Louis, Mo. Secretary-treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research finance committee chairman, to be appointed.

**SAN ANTONIO.** Regular meeting date to be announced. Secretary-treasurer, Joseph C. Brown, c/o Friedrichs' Refrigerators, Inc., 1117 E. Commerce Street, San Antonio, Texas.

**SAN FRANCISCO** meets second Thursday of each month, alternating between St. Julien Restaurant, 140 Battery Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-treasurer, Floyd W. Browning, c/o L. H. Butcher Co., 15th and Vermont Streets, San Francisco, Calif. Research finance committee chairman to be appointed.

**SEATTLE.** Regular meeting date to be announced. Secretary, Mrs. Helen Archibald, 17560 Tenth Avenue, N. W. Seattle, Wash.

**SOUTHEASTERN** meets second Friday of each month at the Belmont Steak House, Atlanta, Ga. Secretary-treasurer, W. T. Weymouth, 173 Clay Street, S. E., Atlanta, Ga.

**SOUTHERN TIER.** Regular meeting date to be announced. Secretary, Vincent T. Maxian, 3 Wilson Street, Binghamton, N. Y.

**SPRINGFIELD** meets fourth Monday of each month in Blakes Restaurant, 15 Market Street, Springfield, Mass. Secretary, Henry L. Heissfeld, 74 Chilson Street, Springfield 8, Mass. Research finance committee chairman, John E. Costigan, 74 Clairmont Avenue, Longmeadow, Mass.

**SYDNEY** meets second Thursday of each month at 7:30 P.M. at 155 King St., Sydney. Secretary-treasurer, M. Taylor, 44 Aubin St., Neutral Bay, N.S.W., Australia.

**SYRACUSE** meets third Monday of each month in Richard's Restaurant. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research finance committee chairman, K. S. Parnell, 829 Maryland Avenue, Syracuse, N. Y.

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**TOLEDO** meets first Thursday of each month at Park Lane Hotel. Dinner 6:30 P.M.; meeting 8 P.M. Secretary-treasurer, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

**TORONTO** meets second Friday of each month in Royal York Hotel. Dinner 6:30 P.M.; meeting 8:30 P.M. Secretary, Robert L. Edwards, 1106 Dovercourt Road, Toronto, Ontario, Canada. Research finance committee chairman, K. Wells, 370 Victoria Avenue, Toronto, Ontario, Canada.

**TWIN CITY** meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 6:30 P.M. and business and technical session at 8:00 P.M. Secretary-treasurer, Robert L. Buckley, c/o Industrial Chemical and Equipment Company, 205 11th Avenue So., Minneapolis 15, Minn. Research finance committee chairman, to be appointed.

**WATERBURY** meets second Thursday in September through May in Elton Hotel. Dinner 6 P.M.; meeting 8 P.M. Secretary-treasurer, Spencer L. Henn, P. O. Box Drawor B, Cheshire, Conn.

**WESTERN ONTARIO** meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-treasurer, J. Vollans, 1262 McDougall Street, Windsor, Ontario, Canada.

**WICHITA** Meeting place indefinite. Secretary-treasurer, Walter Turner, 400 N. Emporia, Wichita, Kans.


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## *AES Report*

*(Continued from page 196)*

**TWIN CITY:** Donald F. Drogue from Indianapolis

### Resignations

**CINCINNATI:** Aaron Leigh, Robert E. Thompson (they were suspended in error)

**SAN FRANCISCO:** Hugh Morgan, A. H. Nicholson

**TORONTO:** I. J. Majka, Dr. Westman

**TWIN CITY:** Bruce Jackson, Carl Lewis, Henry Makino, Ralph G. Poole, Dean C. Thom

### Suspensions

**ALLENTOWN-READING:** Jack Ridge

**CINCINNATI:** Stanley Garfinkel, Donald J. Kunz (reinstated by mistake)

**CLEVELAND:** S. D. Brode, J. H. Carlton, William K. Cusick, Charles C. Francis, John Hemel, Howard S. Jenkins, Leo W. Johnson, Clarence R. Jordan, Allen G. Larson, Donald V. Lippenberger, Frank J. Michelbrink, Terrance A. O'Neil, William R. Peate, Edward Prikryl, Steven Tachovaka

**DETROIT:** Arrigo Baldini, Alfred O. Bragg, H. E. Carlson, Charles M. Cook, James A. Dodd, Alfred H. Filthaut, Frank J. Garrity, Lincoln M. Horton, Charles H. Houghton, James M. Knott, Jack E. Lawson, Bernard P. Michael, Morie Nelson, Robert C. Olsen, William Shaw, Phillip Undieme, Leslie A. Watkins, Richard J. Wisniewski

**LOS ANGELES:** Robert E. Becker, Charles W. Crowl, George Duncan, Richard Foster, Wallace M. Francis, Raymond Karczynski, Bernard Lupescu, Sherman A. Meade, Melvin A. Manell, Ralph G. Skagg, Paul H. Smith, Jack G. Stone, Harold A. Shepard

**NEWARK:** Edward L. Gann, Jr.

**NEW YORK:** Paul Hudec, J. R. Ippolito (in armed forces)

**SAN FRANCISCO:** W. T. McFarlane

**TORONTO:** Neil Hepburn, J. M. Le Roy, A. Peck, W. E. Redfern, C. P. Woodruff

**TWIN CITY:** L. N. Gushard

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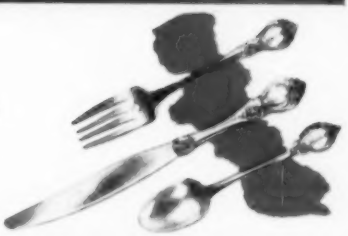

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